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ABSTRACT

This guide to science, technology, and society (STS) education was assembled to assist school districts, curriculum specialists, and teachers in implementing STS in schools. The following categories of resources are included: newsletters and journals; academic series; general reading list; recent periodical literature; selected STS literature in ERIC; selected state education documents; selected programs and materials for elementary, middle school/junior high and high school; student assessment instruments and information; teacher in-service workshop materials; current periodical sources; films and videotapes; and computer software. (DB)

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Science, Technology and Society

RESOURCES FOR STS EDUCATION

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RESOURCES FOR STS EDUCATION

Compiled by
Dennis W. Cheek

STS education has enjoyed growing acceptance at international, national, state, and local levels since the early eighties. This guide to literature in STS education has been assembled to assist school districts, curriculum development specialists, and classroom teachers to locate STS materials germane to their interests and needs. No attempt is made here to assess the relative worth of the respective materials listed nor does listing here imply National STS Network endorsement. Some of the curriculum materials and trade books have been reviewed within previous editions of the STS Reporter or its predecessor, the S-STS Reporter. Much of the material has not been reviewed in either of these two publications. Continual updating of curriculum and instructionally related materials listed here can be found in the PSInet database of the Council of State Science Supervisors. The National STS Network is a participant in PSInet and attempts to keep such information current.

NEWSLETTERS AND JOURNALS RELATED TO STS

1. American Heritage of Invention and Technology, American Heritage Inc., 60 Fifth Ave, NY, NY 10011, $12 yr., 4 issues

   Short illustrated articles about key inventions and technological devices that have shaped American life.

2. The Bulletin of Science, Technology, and Society, STS Press, Materials Research Laboratory, The Pennsylvania State University, University Park, PA 16802, $40 yr., 6 issues

   The official publication of the National Association of Science, Technology and Society (NASTS). A newsletter published alternate months compliments the Bulletin. Registrants of the annual Technological Literacy conference held in February each year in the Washington D.C. area are automatically registered as a member for the subsequent year's publications.

3. Chautauqua Notes, Science Education Center, The University of Iowa, 759 Van Allen Hall, Iowa City, IA 52242, no charge.

   Brief articles, notices of important meetings, and explanations of classroom ideas and curriculum targeted to middle school level.

4. Connect, Connecticut Energy Council for Teachers, 1800 Asylum Avenue, West Hartford, CT 06117, no charge.

   Not explicitly related to STS education but contains useful tips and information related to energy education.

5. Development Forum, P. O. Box 5850, Grand Central Station, NY, NY 10163-5850, $25 yr., 6 issues.

   Published by the United Nations Department of Public Information for the Joint U.N. Information Committee. A 24-26 page newspaper that features coverage of U.N. activities related to development as well as general articles about development in various nations.

6. F.A.S. Public Interest Report, Federation of American Scientists, 307 Massachusetts Avenue, NE, Washington, DC, 20002, $25 yr., 10 issues a yr.

   Information related to ending the nuclear arms race from the oldest organization of its type - the former Federation of Atomic Scientists, founded in 1945.

7. Future Survey, World Futures Society, 4916 St. Elmo Avenue, Bethesda, MD 20814-5089, $59 yr.

   Monthly abstracts of books, articles, and reports concerning forecasts, trends, and issues about the future.

8. The Futurist, World Future Society, 4916 Saint Elmo Avenue, Bethesda, MD 20814, $25 yr. membership fee includes this bimonthly publication.

   Wide ranging publication that looks at possible futures, short articles that report on items in other publications related to futurism, and evaluation of futurist thought.

9. gene WATCH, 186 South Street, 4th Floor, Boston, MA 02111, $12 yr., 6 issues

   Published by the Council for Responsible Genetics. Focus is on discussion, evaluation, and dissemination of information related to social impacts of genetic engineering.

10. Humanities and Technology Association Newsletter, c/o James Gray, Dept. of Technology , Northern Kentucky University, Highland Heights, KY 41076, $6 yr. for membership which includes the newsletter.

    Articles, books of interest, and news items concerning the cultural interaction of the humanities, science, engineering, and technology. The society attempts to define how humanistic concerns interface with technological achievements and advances.

11. IEEE Technology and Society Magazine, The Institute of Electrical and Electronics Engineers Inc., 345 East 47th Street, New York, New York 10017-2394

    Quarterly magazine of the IEEE Society on Social Implications of Technology. Includes issues of health and safety, engineering ethics, social issues related to energy, information technology, telecommunications, peace technology, public and engineering education in social implications of technology, and economic issues related to technology.

12. Interaction, Global Tomorrow Coalition, 1325 G Street, NW, Suite 1003, Washington, D.C. 20005, no charge

    General information and resources regarding global issues, concentrating on those available through the Coalition.

13. Issues in Science and Technology, National Academy of Sciences, 2101 Constitution Avenue, Washington, D.C. 20005, $36 yr., four issues

    A high quality publication which features articles of general interest in science and technology and position papers regarding controversial issues.

14. Laser, Pittsburgh Regional Center for Science Teachers, Carnegie Institute, 4400 Forbes Avenue, Pittsburgh, PA 15213, no charge.

    A newsletter that describes the activities of the Center, upcoming meetings at the local and national level of interest to science teachers, and news about teaching activities in science in the Pittsburgh area. A page of each issue is devoted to STS education.

15. Missive of the STS-Research Network, Glen Aikenhead, College of Education, University of Saskatchewan, Saskatoon, Sask., Canada S7N 0W0, several issues per year.

    The publication of the special interest group on STS within the International Organization for Science and Technology Education (IOSTE), Secretary/treasurer of IOSTE is J. van-Trommel, P. O. Box 2061, 7500 CB Enschede, The Netherlands. Yearly membership is $50.

16. Newsletter of the Teachers Clearinghouse for Science and Society Education, c/o New Walden-Lincoln School, 1 West 88th Street, NY, NY 10024, no charge, 3 issues per year plus an annual supplement on a single topic.

    The Teachers Clearinghouse has been publishing a newsletter regarding STS since the early eighties under the sponsorship of the Association of Teachers in Independent Schools. In addition to general articles about various topics and events, the newsletter reviews STS curricula. Back issues

are available including the annual supplements on nuclear issues (1983), population (1984), water (1985), hazardous wastes (1986), biotechnology (1987), and air quality (1988).

17. Nucleus, Union of Concerned Scientists, 26 Church Street, Cambridge, MA 02238, 4 issues yr., no charge.

    Articles and items related to nuclear power safety, nuclear arms control, and national energy policy.

18. Philosophy and Technology, Kluwer Academic Publishers, 101 Philip Drive, Norwell, MA 02061, $25

    The premier journal for the philosophy of technology with extensive, academic articles, reviews, and items of interest.

19. Physics and Society, the newsletter of the Forum on Physics and Society, a division of the American Physical Society. 4 issues a year, $10 suggested fee, free upon request. Contact Art Hobson, Editor, Physics Department, University of Arkansas, Fayetteville, AR 72701.

    General articles concerning physics and society, book reviews and news items. The focus is on the social implications of physical theories and applied physics.

20. PSLS, Publication of the Society for Literature and Science, c/o David Porush, Secretary-Treasurer, Dept. of Language, Literature and Communication, Rennsselaer Polytechnic Institute, Troy, NY 12181, $15 includes membership and newsletter, 4 issues.

    General articles, book reviews, and extensive bibliographies are regular features of this publication.

21. Regeneration, Rodale Press, 33 E. Minor Street, Emmaus, PA 18098, $25 yr., appears bimonthly.

    Brief articles and news information to help people enhance their capacities, build community spirit, strengthen their local economy, and improve their living environment.

22. Resource Report/Teaching Resources, The Northeast Resource Center for Science and Engineering, City College of New York, Convent Avenue at 138th Street, NY, NY 10031, no charge.

    Not specifically STS in focus, this newsletter features currently available teaching resources in the general areas of science and engineering.

23. Science, Technology & Human Values, Sage Publications Inc., 2111 West Hillcrest Drive, Newbury Park, CA 91320, $37 per yr., 4 issues.

The journal of the Society for Social Studies of Science. Research and commentary concerning the development and dynamics of science and technology, including their involvement in politics, society, and culture are featured.

24. Science, Technology and Society Curriculum Development Newsletter, STS Program, Lehigh University, 327 Maginnes Hall #9, Bethlehem, PA 18015, $8 yr, 6 issues.

A publication focused on college level STS courses which contains course syllabi, reading lists, book reviews, and other pertinent information.

25. Science as Culture, Free Association Books, 26 Freegrove Road, London, N7 9RQ, England, $35 a year (U.S. checks accepted), 4 issues.

Articles about how science, broadly defined, is involved in shaping the values which contend for influence over the wider society. Books are reviewed and general publications are advertised.

26. Social Studies of Science, SAGE Publications Ltd., 28 Banner Street, London EC1Y 8QE, England, $39 yr., quarterly

An international review of research in the social dimensions of science and technology with in-depth articles, book reviews, and notices regarding conferences.

27. STS Reporter, National STS Network, 117 Willard Building, The Pennsylvania State University, University Park, PA 16802, no charge, 4 or more issues per yr.

The official publication of the National STS Network which features curriculum and trades book reviews related to STS education as well as general articles regarding STS education. The earlier S-STS Reporter is available over the ERIC system.

28. Technology and Culture, Society for the History of Technology, University of Chicago Press, Journals Division, P.O. Box 37005, Chicago, IL 60637, $26 yr. for membership in the society which includes 4 issues of the journal.

The premier journal for the history of technology. Features in-depth articles from all periods of history as well as extensive book reviews in each issue.

29. Technology in Society, Pergamon Press, Fairview Park, Elmsford, NJ 10523, $157 yr., 4 issues.

An international journal devoted to a range of interdisciplinary fields most simply identified by the terms: technology assessment, science, technology, and society; management of technology; technology and policy, the economics of technology; technology transfer; appropriate technology and economic development; ethical and value implications of science and technology; science and public policy; and technology forecasting. A focus common to all these fields is the role of technology in society - its economics, political and cultural dynamics; the social forces that shape technological decisions; and the choices that are open to society with respect to the uses of technology.

30. Technology Review, Association of Alumni and Alumnae of M.I.T., Building W59, Cambridge, MA 02139, $24, 8 times yr.

Semi-popular articles that explains key technologies recently employed or under development as well as book reviews.

31. Technology Studies, Center for Technology Studies, New Jersey Institute of Technology, Newark, NJ 07102, no charge but limited to educational, research, government, and public agencies, as well as interested individuals primarily in the state of New Jersey.

General information about national movements and detailed news about efforts in New Jersey regarding the teaching of technology and its social implications in schools and colleges.

32. TIES - Technology, Innovation and Entrepreneurship for Students, TIES Magazine, College of Design Arts, Drexel University, Philadelphia, PA 19104, $15 per yr., 6 issues, free to technology teachers and administrators.

Articles about leading technologists, features about great inventions, challenges to young innovators, new ways to look at old problems and old ways to look at new ones, the strange made familiar and comprehensive, is the standard fare of this new magazine.

33. Triangle Coalition Network News, Triangle Coalition for Science and Technology Education, 5112 Berwyn Road, 3rd Floor, College Park, MD 20740, no charge, monthly.

Up to date information about the work of the Triangle Coalition as well as general developments regarding school/business partnerships and science, technology, and mathematics education.

34. Update, Science Education Center of Greenwich, Connecticut Post Office Box 7404, Greenwich, CT 06836, no charge

A newsy, down to earth publication for the classroom teacher that contains news about recent developments in science education, special programs and projects of interest to science teachers, and resources available across the nation for science teaching.

35. The Weaver, Council for the Understanding of Technology in Human Affairs, Division of Engineering, Brown University, Providence, RI 02912, no charge

A newspaper that contains general articles and lists of resources for teachers interested in increasing both their own and their students' understanding of technology in human affairs.

36. World Watch, World Watch Institute, 1776 Massachusetts Avenue, NW, Washington, DC 20036, $20, 6 issues.

The official journal of the Institute with articles that survey pressing global problems and news items related to global issues.

ACADEMIC SERIES IN STS STUDIES

A number of university presses have instituted series dealing with aspects of STS studies. Addresses of the respective presses and a brief description of the kinds of manuscripts they will be publishing are listed below. Further information may be obtained from the respective publisher.

Research in Technology Studies, The Lehigh University Press.

Volumes of essays centered around specific themes related to the social, political, cultural, and values dimensions of technology. Inquiries and submissions should be addressed to the series co-editors, Stephen H. Cutcliffe, Steven L. Goldman, Research in Technology Studies, c/o STS Program, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015.

Science, Technology and Culture, Worcester Polytechnic Institute

Critical studies, monographs, tightly-edited collections of essays, and research tools in interdisciplinary topics which investigate the relationships of science and technology to social and cultural issues and impacts. Contact: Lance Schachterle, Francis C. Lutz, Editors, Studies in Science, Technology, and Culture, The Projects Center, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA 01609.

Research in Philosophy and Technology, JAI Press

A large number of volumes have already appeared in this series with more continually under preparation. Contact: JAI Press, 36 Sherwood Place, Greenwich, CT 06836.

Science, Technology, and Society, SUNY Press

General studies of science, technology, and society which offer empirical, critical, and theoretical contributions to our understanding of the social, ethical, and value dimensions of science and technology, and of science and technology policy. Contact: Rosalie M. Robertson, Editor, SUNY Press, State University Plaza, Albany, New York, 12246.

Studies in Science and Culture, University of Delaware

Three volumes have already appeared. Each was the winner of an annual contest. Cultural rather than policy studies such as the history of science or technology in cultural perspective; philosophical analyses of the ethical, social, and cultural dimensions of science and technology; or studies of these fields from the perspective of the humanistic social sciences are planned. Contact: Science, Technology, and Culture Competition, University of Delaware Press, 326 Hullihen Hall, Newark, DE 19716.

The Indiana Series in the Philosophy of Technology, Indiana University Press.

Critical and reflective views of the relationship of technology to human life and society are planned. Contact: Janet Rabinowitch, Senior Sponsoring Editor, Indiana University Press, Bloomington, IN 47405.

A GENERAL READING LIST ON STS

The following set of books does not pretend to be the definitive list of essential books to read if you are engaged in STS education. These are some suggestions of recent books to increase awareness and expand personal expertise. Many other useful books are brought to the attention of readers in the pages of the Bulletin of Science, Technology & Society and other publications listed above.

Abraham, Michael R., Ed., Science Education/Society: A Guide to Interaction and Influence, ERIC Clearinghouse for Science, Mathematics, and Environmental Education, The Ohio State University, Columbus, OH, 43212, 1978, 337 pp.

The 1979 Association for the Education of Teachers in Science yearbook. A number of chapters treat such topics as energy, population, pollution, natural resources, technology, genetic issues, and drugs. Additional sections consider the influence and interaction between science education and society.

Aicken, Frederick, The Nature of Science, Heinemann Education Books, Portsmouth, NH, 1984, 136 pp.

Written as a series of discrete essays with beginning questions and ending with suggested readings, the book aims to present a wider view of science than that normally conveyed to students in school. The interaction of science with religion, philosophy, and personal lifestyle is particularly emphasized.

Aronowitz, Stanley, Science as Power - Discourse and Ideology in Modern Society, University of Minnesota Press, Minneapolis, 1988, 384 pp.

By tying its truth claims to methodology, science has claimed independence from the influence of social and historical conditions. Science is viewed by most twentieth century persons as an authority beyond critique, whose norms and values are neutral, self-evident, and absolute. Aronowitz attempts to demolish this myth by careful study of the discourses about science. He argues that only a social theory of science that combines critical distance with historical analysis can provide the precondition for the development of a new, more accurate, view of science.

Baark, Erik, Uno Svedin, Eds., Man, Nature, and Technology - Essays on the Role of Ideological Perceptions, St. Martin's Press, New York, 1988, 150 pp.

Rather than focus on the usual environmental sciences or engineering sciences approaches to STS, these eight essays from a Swedish project, consider the ways in which ideological perceptions condition how we see our relationship to both nature and technology.

Back, Julie S., Ed., Biomedical Ethics - Opposing Viewpoints, Greenhaven Press, St. Paul, MN, 1987, 216 pp.

A consideration of five key biomedical ethics questions with several contributions to each issue: 1) is genetic engineering ethical?, 2) are organ transplants ethical?, 3) should limits be placed on reproductive technology?, 4) should animals be used for scientific research?, and 5) what ethical standards should guide the health care system?

Barbour, Ian G., Technology, Environment and Human Values, Praeger Publishers, NY, 1980, 319 pp.

Examines the conflicting material, social and environmental values and political forces involved in difficult policy decisions related to technology and the environment. Analytical decision-making methods, the role of experts, institutional biases, and personal life styles and their consequences are explored.

Barman, Charles R., John J. Rusch, Timothy M. Cooney, Science and Societal Issues - A Guide for Science Teachers, Iowa State University Press, Ames, 1981, 151 pp.

The authors argue that the impact of science and technology upon modern life necessitates science educators providing opportunities for value decisions in their classes regarding critical science/society topics. Specific guidelines are proposed and resources to aid in such discussions are suggested.

Basalla, George, The Evolution of Technology, Cambridge University Press, New York, 1988, 248 pp.

This book presents an evolutionary theory of technological change based upon scholarship in the history of technology, economic history, and anthropology. It argues that all technological advances are rooted in the past and uses major achievements of Western technology (the waterwheel, printing press, steam engine, automobiles and trucks, and transistor) to support the theoretical framework. Three themes - diversity, necessity, and technical evolution - dominate the discussion.

Bellini, James, High Tech Holocaust, Sierra Club Books, San Francisco, 1986, 255 pp.

From Love Canal to Bhopal, Chernobyl to Brazil, Bellini investigates technologically induced disasters, exposing undercurrents of individual, corporate, and national greed and deception that supports industrial pollution and the rape of the environment. A book in the "doomsday" tradition, Bellini calls for moral action on the part of all world citizens to rescue us from this sad state of affairs.

Bernard, H. Russell, Pertti Pelto, Eds., Technology and Social Change, Waveland Press, Prospect Heights, IL, 2nd ed., 1987, 393 pp.

Thirteen case studies of technology and social change including a look at rural dam projects, sponge fishing in Greece, snowmobiles in the Arctic, microtechnology in rural Buganda, and a general discussion of technology and anthropological theory.

Bignell, Victor, Joyce Fortune, Understanding System Failures, Manchester University Press, Dover, NH, 1984, 216 pp.

A dozen case histories ranging from Three Mile Island to the collapse of Rolls-Royce and the sinking of a North Sea oil rig, becomes the basis for an approach to system failures in the widest possible sense. Five basic factors are identified as critical contributors to systems failure: the final system itself, control, communication, engineering reliability, and human factors.

Bijker, Wiebe E., Thomas P. Hughes, Trevor Pinch, Eds., The Social Construction of Technological Systems, The MIT Press, Cambridge, MA, 1987, 405 pp.

These thirteen essays have been written by a diverse group of scholars drawn together by a common interest in creating a new field of study - the sociology of technology. They draw on a wide array of examples, from bicycles to missiles, ultrasound to expert systems. Together they affirm the need for social studies of technology that give equal weight to technical, social, economic, and political questions.

Blumenberg, Hans, The Genesis of the Copernican World, The MIT Press, Cambridge, MA, 1987, 772 pp.

A translation of the 1975 German language work that is a monumental rethinking of the significance of the Copernican revolution for our understanding of modernity. Demonstrates that the Copernican world view was not the result of scientific developments per se but arose primarily due to systematic changes in the areas of religion, philosophy, and metaphor.

Boroush, Mark A., Kan Chen, Alexander N. Christakis, Eds., Technology Assessment: Creative Futures - Perspectives from and Beyond the Second International Congress, North Holland, NY, 1980, 405 pp.

Partially stimulated by presentations and discussions at the Second International Congress on Technology Assessment at the University of Michigan in 1976, this reference presents critical issues, methodologies, and paradigms in technology assessment in six large chapters with 52 contributors.

Bowers, C. A., The Cultural Dimensions of Educational Computing - Understanding the Non-Neutrality of Technology, Teachers College Press, New York, 1988, 152 pp.

Bowers, focusing on the ubiquitous computer and its use in instruction, argues that technology is not a neutral tool of society or the educator. The computer reinforces our historical-cultural view of knowledge as power and views about progress and individual autonomy. The computer is then seen as a vehicle for cultural transmission and the proper role of the teacher is to be a reflective practitioner who clearly understands the implications of this fact.

Braun, Ernest, Stuart Macdonald, Revolution in Miniature - The History and Impact of Semi-Conductor Electronics, Cambridge University Press, New York, rev. ed., 1982, 247 pp.

The first edition found a wide readership despite the highly technical nature of the subject matter. This is a revision of this sound historical study of the development of one of the major technologies of this century. A useful understanding of the processes at the heart of technological change and societal impacts of technology can be gained from the contexts of this industry.

Breeden, Robert L., Ed., Those Inventive Americans, National Geographic Society, Washington, D.C., 1971, 231 pp.

Snapshots of America's inventors, that aided by 242 illustrations from National Geographic files, visually documents the technological development of our nation.

Brown, Lester R., et al., The State of the World, W. W. Norton and Company, New York

1984 - stabilization of population, reducing dependence on oil, conserving soils, protecting forests, recycling materials, reassessing the economics of nuclear power, developing renewable energy, reconsidering the automobile's future, securing food supplies, and reshaping economic policies are the chapters for this annual volume.

1985 - this volume covers the following topics: reducing world hunger, managing freshwater supplies, maintaining world fisheries, protecting forests from air pollution and acid rain, conserving biological diversity, increasing energy efficiency, harnessing renewable energy, and stopping population growth.

1986 - assessing ecological decline, increasing water efficiency, managing rangelands, moving beyond oil, reforming the electric power industry, decommissioning nuclear power plants, banishing tobacco, investing in children, reversing Africa's decline, and redefining natural security.

1987 - analyzing the demographic trap, assessing the future of urbanization, reassessing nuclear power, electrifying the Third World, realizing recycling's potential, sustaining world agriculture, raising agricultural productivity, stabilizing chemical cycles, and designing sustainable economies.

1988 - this volume explores: the earth's vital signs, creating a sustainable energy future, raising energy efficiency, shifting to renewable energy, reforesting the earth, avoiding a mass extinction of species, controlling toxic chemicals, assessing SDI, planning a global family, and reclaiming the future.

1989 - a world at risk, halting land degradation, reexamining the world food prospect, abandoning homelands, protecting the ozone layer, rethinking transportation, responding to AIDS, enhancing global security, mobilizing at the grassroots, and outlining a global action plan are chapters in this book.

Brush, Stephen G., The History of Modern Science - A Guide to the Second Scientific Revolution, 1800-1950, Iowa State University Press, Ames, 1988, 544 pp.

A comprehensive reference that contains an overview of the second scientific revolution followed by an annotated list of books and reference materials. A series of self-contained chapters outlines major developments in such fields as biology, anthropology, psychology, physics, mathematics, and astronomy. Each chapter contains suggested readings, synopses of important topics and select bibliographies of specialized scholarly monographs and articles.

Burke, John G., et al., Eds., Science and Culture in the Western Tradition, A Reader/Study Guide for the Telecourse, Gorsuch Scarisbrick Publishers, Scottsdale, AZ, 1987, 336 pp. of readings and a 168 pp. study guide in one volume.

Designed for a three credit college course integrating the BBC film series and accompanying book by James Burke, The Day the Universe Changed, and video discussion programs hosted by Benjamin Dunlap featuring historians, philosophers, and practicing scientists and engineers. The entire set is available through the Coast Community College District, Costa Mesa, CA. This resource reader can also profitably be read separately, especially by those already familiar with Burke's work. Sixty seven readings feature both classical and contemporary scholars, originators and appraisers, practitioners and researchers.

Bybee, Rodger, Janet Carlson, Alan McCormack, Eds., Redesigning Science and Technology Education, National Science Teachers Association, Washington, D.C., 1984, 248 pp.

The 1984 Yearbook of NSTA, this volume features articles by a number of well known science educators regarding aspects of STS education.

Carin, Arthur A., Robert B. Sund, Teaching Science through Discovery, Merrill Publishing Company, Columbus, OH, 6th ed., 1989, 575 pp.

A classic one volume textbook for the preparation of science teachers. Chapter 3 focuses exclusively on STS answering the question: "What are the implications for developing decision making processes?". Chapter 10 discusses integration of science with other subject areas while chapter 13 considers the use of electronic technologies, including computers, in science teaching. Over 150 pages of guided discovery science resource activities end this text. A shorter version without this final section is Teaching Modern Science, Merrill Pub. Co., Columbus, OH, 5th ed., 1989, 383 pp.

Chalk, Rosemary, Ed., Science, Technology and Society - Emerging Relationships, American Association for the Advancement of Science, Washington, D.C., 1988, 262 pp.

A collection of papers from Science from 1949-1988 grouped around ten major themes: science and responsibility, science and freedom, science and ethics, the human side of science, scientists and citizens, science and the modern world, fraud and misconduct in science, professional rights and duties in the health sciences, science and risk, and science and national security. An appendix contains the full texts of committee reports of the AAAS Committees on Civil Liberties for Scientists, Social Aspects of Science, Science in the Promotion of Human Welfare, and Scientific Freedom and Responsibilities. An index of subjects and persons enhances the volume's usefulness.

Chubin, Daryl E., Ellen W. Chu, Eds., Science Off the Pedestal - Social Perspectives on Science and Technology, Wadsworth Publishing Company, Belmont, CA, 1989, 196 pp.

Fourteen carefully selected articles demonstrate that science is a social system operating within the culture at large. Each reading examines a particular historical or contemporary problem (e.g. scientists and the media, fraud in science, the effect of technology information on workers' perceptions of risk) that illustrate how science and technology are tied to social institutions of government, education, industry, and the economy.

Coates, Joseph F., Jennifer Jarratt, What Futurists Believe, Lomond Publications, Mt. Airy, MD, 1989, 340 pp.

The authors, one the former head of the Office of Technology Assessment, summarize and critique discriminatingly the views of 17 leading world futurists in this book co-sponsored by the World Future Society. Judicious verbatim quotations footnoted to the original sources enable a reader to verify the context of the views presented and evaluated. An excellent concluding chapter summarizes the limitations of futurist forecasting while highlighting its potential benefits.

Cohen, Victor, News and Numbers - A Guide to Reporting Statistical Claims and Controversies in Health and Related Fields, Iowa State University Press, Ames, 1989, 178 pp.

This book was written for newspaper reporters to improve their ability to accurately report statistical laden information and claims. Teachers without an adequate grounding in statistics, will benefit from this simple and non-mathematical "how to" guide to read and judge the contentions of scientists, doctors, environmentalists, politicians, and economists.

Considine, Douglas M., Glenn D. Considine, Eds., Van Nostrand's Scientific Encyclopedia, Van Nostrand Reinhold, New York, 7th ed., 1989, 2 volumes, 3180 pp.

The premier reference work in its field for quick access to current information regarding all aspects of scientific development and understanding. Larger articles are written by subject experts and include brief bibliographies for further reading. Some coverage of technology is also included. Literally hundreds of topics related to STS are briefly surveyed in this delightful cornucopia of scientific knowledge.

Cutcliffe, Stephen H., Robert C. Post, Eds., In Context - History and the History of Technology - Essays in Honor of Melvin Kranzberg, Lehigh University Press, Bethlehem, PA, 1989, 278 pp.

Fourteen essays plus a closing essay by Melvin Kranzberg make this a useful view of the contextual, sociocultural surroundings of technology. Diverse topics presented include the roots of the Industrial Revolution, the relationship between science and technology, the value of particular types of source materials, the writings of key philosopher-historians of technology, and gender studies and technology. A select bibliography of publications by Kranzberg as well as a comprehensive bibliography of works cited by the essayists close the book.

DeBresson, Chris, Understanding Technological Change, Black Rose Books, Cheektowaga, New York, 1987, 270 pp.

This book, originally prepared for an evening course for adults principally from labor unions, is intended as a general reference guide to understand the forces behind technological change. An overall analytical framework is presented. Then specific and numerous case histories are employed to demystify underlying causes explaining technical change. Seven major forces that motivate and shape technical change (working knowledge and learning, technical adaptation, economics, science, politics, culture, and the search for status) are then examined. A focus on proposals for change regarding thinking and acting about technological change emphasizing democratization and human choice bring this worthwhile discussion to a close. A lengthy appendix of authentic documents by labor unions regarding technical change, checklists to aid review about technology and change, and numerous tables, graphs, illustrations and definitions enhance this very useful book.

DeForest, Paul, Mark S. Frankel, Jeanne S. Poindexter, Vivian Weil, Biotechnology - Professional Issues and Social Concerns, Office of Scientific Freedom and Responsibility, American Association for the Advancement of Science, Washington, D.C., 1988, 111 pp., no charge.

Papers from two symposia of the AAAS Committee on Scientific Freedom and Responsibility in 1987 constitute the bulk of this document. The first set of papers considers the topic of corporate-academic ties in biotechnology. The second set of papers focuses on the "Responsible Uses of Microorganisms and Microbiological Products".

Deken, Joseph, The Electronic Cottage, Bantam Books, New York, 1981, 383 pp.

A professional statistician explains in admirably clear fashion the secrets and horizons of the computer revolution in entertainment, communication, and creativity. If computers make you uneasy, this is perhaps the best beginner's book on market. Useful points about the limitations of computing and computers distinguishes this book from its "gee-whiz" competitors.

Dertouzos, Michael, Richard K. Lester, Robert M. Solow, Made in America - Regaining the Productive Edge, The MIT Press, Cambridge, MA, 1989, 344 pp.

This book summarizes the findings and policy implications of the MIT Commission on Industrial Productivity. Based on hundreds of interviews on three continents and additional detailed research into eight major industries from textiles to computers, Made in America cites a handful of key recurring weaknesses that contribute to the productivity problem: short term horizons, preoccupation with short-term

returns, outdated strategies that focus on mass production and the domestic market, failures of industry cooperation, neglect of human resources, technological failures in translating discoveries into products, and a public-policy environment often at cross-purposes with industry. An argument for large scale systemic change is made.

DeVore, Paul W., Technology - An Introduction, Davis Publications Inc., Worcester, MA, 1980, 399 pp.

A college level introductory textbook that surveys the philosophical, historical, and contextual nature of technology, replete with numerous diagrams, graphs, and charts.

Didsbury, Howard F. Jr., Ed., The Future: Opportunity Not Destiny, World Future Society, Bethesda, MD, 1989, 301 pp.,

A selection of the best papers from the World Future Conference of 1989. Twenty-three papers are grouped under six main headings: 1) a historical retrospective, 2) economics, development and the future, 3) meeting challenges, 4) applying futures research, 5) new mental attitudes, and 6) humanist views of the future.

Dostrovsky, I., Energy and the Missing Resource - A View from the Laboratory, Cambridge University Press, New York, 1988, 182 pp.

In this informative and thought-provoking book, a leading energy researcher, demonstrates that sufficient resources are available to meet all energy needs for the foreseeable future. However, this does not remove the threat of an energy-supply crisis since what is lacking is the knowledge of how to use these resources in a practical and environmentally acceptable manner.

Dryzek, John S., Rational Ecology - Environment and Political Economy, Basil Blackwell, New York, 1987, 270 pp.

The author analyzes the variety of institutional arrangements through which collective social decisions are achieved, concentrating particularly on the global problems of ecology. Innovations for improving the process of social decision making are proposed.

Durbin, Paul T., Ed., The Reader's Advisor - Vol. 5: The Best in the Literature of Science, Technology, and Medicine, 13th ed., R. R. Bowker Co., New York, 1988, 725 pp.

Bibliographic authorities from a host of disciplines have provided chapters for this volume that feature biographies of outstanding contributions, brief general discussions, and copious annotations to works that are critical to the history, development, and understanding of the selected field. Specific chapters are devoted to general science;

history of science, technology and medicine; philosophy of science and pseudoscience; mathematics; statistics and probability; information and computer sciences; astronomy and space science; earth science; physics; medicine and disease; clinical psychology and psychiatry; engineering and technology; energy; science, technology, and society; and the ethics of science, technology, and medicine.

Engelhardt, H. Tristram Jr., Arthur L. Caplan, Eds., Scientific Controversies - Case Studies in the Resolution and Closure of Disputes in Science and Technology, Cambridge University Press, New York, 1987, 639 pp.

This collection of 28 essays examines the ways in which disputes and controversies about the application of scientific knowledge are resolved. Four concrete examples of public controversy are considered in detail: the efficacy of Laetrile, the classification of homosexuality as a disease, the setting of safety standards in the workplace, and the utility of nuclear energy as a source of power. These debates clearly show that scientific and technological controversies are structured by complex ethical, economic, and political interests.

Faust, David, The Limits of Scientific Reasoning, University of Minnesota Press, Minneapolis, MN, 1984, 198 pp.

Drawing upon research in cognitive psychology, Faust maintains that human judgment is far more limited than we tend to believe and that all individuals - scientists included - have a surprisingly restricted capacity to interpret complex information. He implies that scientists do not perform reasoning tasks, such as theory evaluation, as well as we assume they do, and that there are many judgments the scientist is expected to perform which he cannot because of restrictions in cognitive capacity.

Fisher, David, Reginald Bragonier Jr., What's What - A Visual Glossary of the Physical World, Hammond Inc., Maplewood, NJ, 1981, 561 pp.

If you know what it looks like (in whole or in pieces) but don't know what it's called, this book is a life-saver. Thousands of names for parts and wholes of objects are labeled on diagrams or photographs of the item in question. Organized by fields with a very comprehensive index, every school library could enrich its collection with this volume.

Forester, Tom, Ed., The Information Technology Revolution, The MIT Press, Cambridge, MA, 1985, 674 pp.

Forty-eight readings, accompanied by guides for further reading and a comprehensive index, make this an excellent introduction to the entire field of information sciences and the associated technologies.

Forester, Tom, High-Tech Society - The Story of the Information Technology Revolution, The MIT Press, Cambridge, MA, 1987, 311 pp.

An excellent overview of the computer revolution and its implications for society. All manner of related technologies are discussed and numerous photographs and line drawings aid the uninitiated. A comprehensive index makes this a valuable reference for teachers who are not up to date with the computer revolution.

Forester, Tom, Ed., The Materials Revolution - Superconductors, New Materials, and the Japanese Challenge, The MIT Press, Cambridge, MA, 1988, 397 pp.

Forester brings together 20 articles from a wide range of sources to provide the first comprehensive survey of this materials revolution and its impact on the economy and society. In addition to superconductivity, the book considers such important topics and applications as successors to silicon, high-performance plastics, fine ceramics, new kinds of fibers, optical fibers, materials innovation and substitution, seabed materials, the processing of materials in space, and the futuristic nanotechnology.

Frankena, Frederick, Joann Koelin Frankena, Citizen Participation in Environmental Affairs, 1970-1986, A Bibliography, AMS Press, New York, 1988, 153 pp.

Just what the title stipulates, this handy reference groups citations into subcategories within five large sections: environmental decision making, energy-related decision making, natural resources decision making, environmental mediation, and science and technology decision making.

Friedrichs, Gunter, Adam Schaff, Microelectronics and Society - For Better or for Worse - A Report to the Club of Rome, Pergamon Press, New York, 1982, 353 pp.

This book is the result of a mandate from the Club of Rome for the editor to prepare a document that would set out the challenges, opportunities and problems of microelectronics for wide public consumption and informed public debate on what strategies to take to ensure that the new technologies will work for the benefit and not the detriment of mankind. Eleven chapters by a team of international scholars, address key issues regarding microelectronics in general and the specifics of the workplace, macroeconomics, the Third World, warfare, the information society, world interdependence, and occupational choice.

Gibson, Mary, Ed., To Breathe Freely - Risk, Consent, and Air, Rowman and Allanheld (Littlefield, Adams & Co.), Totowa, NJ, 1985, 294 pp.

This interdisciplinary collection of 13 original essays addresses pressing questions about air quality, offering policy prescriptions and moral arguments for dealing with airborne risks of different kinds. A survey of the nature and magnitude of risks associated with the most commonly encountered sources of air pollution - cigarette smoke in enclosed places, airborne toxins in the workplace, and airborne pollutants carried over long distance - leads to a discussion of individual consent and its role in the creation of public policy and law.

Goldberg, Steven E., Charles R. Strain, Eds., Technological Change and the Transformation of America, Southern Illinois University Press, Carbondale, IL, 1987, 204 pp.

Thirteen essays, many of them case studies, detail the theme of this volume. Several are critical of the popular myths held in America regarding technology and its beneficence.

Goldschmidt, Bertrand, The Atomic Complex - A Worldwide Political History of Nuclear Energy, American Nuclear Society, La Grange Park, IL, 1982, 478 pp.

This book, by Marie Curie's former personal assistant and an active player in the Manhattan Project and the French Atomic Energy Commission, surveys the global history and politics of the nuclear energy and nuclear weapons industries. He describes how the mistakes of the past set the tone for today's nuclear problems while viewing nuclear energy in a basically positive light.

Goldstein, Thomas, Dawn of Modern Science, Houghton Mifflin Co., Boston, 1988, 296 pp.

The history of scientific thinking from the Greeks through medieval times to the beginnings of the modern world view. Well chosen illustrations complement an engaging text. Bibliographical notes encourage further exploration of topics succinctly discussed in the text.

Grimson, W. Eric, Ramesh S. Patil, Eds., AI in the 1980s and Beyond - An MIT Survey, The MIT Press, Cambridge, MA, 1987, 374 pp.

Chapters on artificial intelligence, expert systems, vision, robotics, and natural language among others, provide a broad overview of current areas of research activity and an assessment of the present and portends of the future in AI.

Hatcher, Donald, Science, Ethics, and Technological Assessment, American Press, Boston, MA, 1987, 220 pp.

A general overview of the area with three main foci: the nature of scientific thinking, developing an ethical framework, and a consideration of technology. A sample project focusing on the Laetrile controversy explores the issues raised in this context.

Hellemans, Alexander, Bryan Bunch, The Timetables of Science - A Chronology of the Most Important People and Events in the History of Science, Simon and Schuster, New York, 1988, 656 pp.

A complimentary volume to the highly acclaimed The Timetables of History and The Timetables of American History, this rich, fact-jammed book contains a chronology of 10,000 separate events in the history of science from the earliest verifiable scientific achievement right up to the most recent breakthroughs of the 1980s.

Hickman, Faith M., John J. Patrick, Rodger W. Bybee, Science, Technology, Society - A Framework for Curriculum Reform in Secondary School Science and Social Studies, Social Science Education Consortium Inc., Boulder, CO, 1987, 55 pp.

A concise framework for STS education which includes discussion of major topics and concepts, cognitive process skills, values and attitudes, alternative curricular designs, and guidelines for specific subject areas in the sciences and social studies.

Hill, Stephen, The Tragedy of Technology - Human Liberation versus Domination in the late Twentieth Century, Pluto Press, London (Unwin Hyman, Winchester, MA), 1988, 294 pp.

Hill's study demonstrates that throughout history there has always been an alignment between the cultural properties of technology and the wider culture in which it is housed. Rather than being a misfortune, he sees the tragedy in the classical Greek sense - as the "remorseless working of things". He questions our contemporary values, explores the processes by which these values are constituted, and guides the reader in deciding how these values may be changed.

Hirschhorn, Larry, Beyond Mechanization - Work and Technology in a Postindustrial Age, The MIT Press, 1984, 187 pp.

Human skill and judgment are needed to run today's complex computerized production system. The new technology blurs the line between management and workers and makes the workplace a spot for learning in a way more reminiscent of the old craftsmanship than mass production. This calls for new roles for unions, management, and the entire factory setting.

Jacob, Margaret C., The Cultural Meaning of the Scientific Revolution, Temple University Press, Philadelphia, 1988, 274 pp.

This careful study by a distinguished cultural historian, examines the process by which scientific knowledge in the 17th and 18th centuries became an inherent part of Western culture. Jacob suggests that it was due to the compatability of scientific knowledge with prevailing political interests and cultural values that science thrived in Europe during this period.

James, Robert K., Ed., Science, Technology and Society: Resources for Science Educators, SMEAC Information Reference Center,the Ohio State University, 1200 Chambers Road, Room 310, Columbus, OH 43212, 1986, 143 pp.

The 1985 Association for the Education of Teachers in Science yearbook. Eleven essays split into three sections consider foundations for the STS frame of reference, models for preparing teachers for STS, and implementation aspects of STS education.

Kowles, Richard V., Genetics, Society & Decisions, Charles E. Merrill Publishers, Columbus, OH, 1985, 579 pp.

The discussions in this college textbook focus on the many important ways in which heredity interrelates with societal activity. Enough initial treatment of basic genetics is given to understand such topics as genetic disorders, consanguinity, genetic counseling and screening, forensic genetics, radiation, aging, behavioral genetics, genetic engineering, and agricultural genetics.

Kramarae, Cheris, Ed., Technology and Women's Voices - Keeping in Touch, Routledge and Kegan Paul, New York, 1988, 246 pp.

The contributors investigate women's talk as part of the technological environment in which it occurs, and argue that technology has made a lasting impact on women's communication. The 14 articles trace the operations of several specific innovations (including electricity, the telephone, washing machine, public transport, car, printing press, microphone, sewing machine, and computer) and explore their effects on women's social interaction. The histories of these innovations are followed up with a broader discussion of how all technological practices affect the ways, places, times, and content of talk and writing. The authors consider technologies not as machines but as social relations.

Lappe, Frances Moore, Joseph Collins, World Hunger - Twelve Myths, Grove Press, New York, 1986, 208 pp.

Data and arguments to explode myths relating to world hunger such as "there's simply not enough food", "the green

revolution is the answer", and "more U.S. aid will help the hungry", are presented. A plan for action, a resource guide, and bibliographic notes assist both further thought and action.

Lappe, Marc, Broken Code - The Exploitation of DNA, Sierra Club Books, San Francisco, 1984, 354 pp.

The history of DNA research, gene-splicing techniques, and the complex scientific and moral issues raised by these technologies, are described in this book. Lappe critiques the absence of long-range planning in this arena - comparing it to the development of nuclear fission. He argues that we are ill-prepared to anticipate what will, or will not, happen when genetically modified plants or microorganisms are released into the natural environment. While technical aspects and practice have increased since this book, the discussion of the overall issues raised is still worth considering.

Latour, Bruno, Science in Action - How to Follow Scientists and Engineers through Society, Harvard University Press, Cambridge, MA, 1987, 272 pp.

Latour demonstrates by a penetrating analysis of science, how social context and technical content are both essential to a proper understanding of scientific activity. Emphasizing that science can only be understood through its practice, the author examines science and technology in action. The role of scientific literature, laboratory activities, the institutional context, and the acceptance of invention and discoveries all fall within his purview.

Leone, Bruno, Ed., et al., Science and Technology - Opposing Viewpoints. Greenhaven Press, St. Paul, MN, 1987, 427 pp.

One hundred readings devoted to fifty key issues regarding science and technology, a glossary of terms, list of organizations, bibliographies, and an index. This volume is supplemented annually with a softcover volume that includes further key issues that have appeared in literature over the past year.

Marcus, Alan I., Howard P. Segal, Technology in America - A Brief History, Harcourt, Brace, and Jovanovich, New York, 1989, 380 pp.

Perhaps the best brief one volume introduction to this subject in print. Each chapter concludes with a helpful bibliography for further reading. A multipage index makes referencing easy and delightful photographs compliment the clear text.

Markert, Linda Rae, Contemporary Technology - Innovation, Issues, and Perspectives, The Goodheart-Willcox Co. Inc., South Holland, IL, 1989, 473 pp.

This college text for courses related to technology and society presents the pervasive nature of technological innovations and both the promises and uncertainties associated with the use of technology as a creative human enterprise. Fourteen chapters introduce the following topics: genetic engineering, artificial intelligence, communication networks, space exploration, medical innovation, manufacturing innovation, technology transfer, global energy resources, broad environmental issues, defense issues, social response to technological change, the stability of traditional social institutions and the technologist's responsibility for the future of technology. An outline, summary, discussion questions, and suggestions for further reading can be found in each chapter.

Marks, John, Science and the Making of the Modern World, Heinemann Educational Books, Portsmouth, NH, 1983, 507 pp.

A wide-ranging historical account of the rise of science and the growth of the scientific community. It explores complex relationships between the development of scientific and technological knowledge and the variable climate of ideologically diverse political and social systems by using case studies from Nazi Germany, traditional China, and modern Japan and topical issues such as nuclear power, biotechnology, and the population explosion.

Miller, G. Tyler Jr., Living in the Environment, Wadsworth Publishing, Belmont, CA, 5th ed., 1988, +600 pages.

A superb and classic overview of the environmental sciences within the contexts of ecology, economics, and politics. An excellent extended bibliography and listing of periodicals and organizations enhances this tremendous resource book.

Minton, Gene D., Beverly K. Minton, Teaching Technology to Children, Davis Publications, Worcester, MA, 1987, 470 pp.

A college level text designed to familiarize teachers with technology and to suggest reasonable methods and strategies to introduce technology to children in a systematic fashion.

Modern Technology : Problem or Opportunity?, Daedalus, Vol. 109, No. 1, Winter 1980, 189 pp.

Twelve authors at a symposium of the American Academy of Arts and Sciences take up the question of the nature and problems of modern technology.

O'Connor, John E., Ed., The Machine in the Garden State - Technological Literacy and STS Curriculum Development in New Jersey, Center for Technology Studies, New Jersey Institute of Technology, Newark, NJ 07102, 91 pp.

A roundtable discussion, an introductory overview, and abstracts and project reports from educational institutions at the college level throughout New Jersey give the reader a clear idea of the ways in which one state is attacking the problem of technological literacy.

Odum, Eugene P., Ecology and Our Endangered Life-Support Systems, Sinauer Associates Inc., Sunderland, MA, 1989, 283 pp.

A succinct overview of ecology by one of its primary founders. Numerous graphs, charts, and illustrations compliment a well-written text.

Oldfield, Margery L., The Value of Conserving Genetic Resources, Sinauer Associates Inc., Sunderland, MA, 1989, 379 pp.

Originally published in 1984 by the U.S. Department of the Interior, this volume summarizes the literature on this vital topic under the key rubrics of plant resources and food production, animal resources and food production, medicinal plant and animal resources, tree resources, natural rubber, natural sources of industrial oils and waxes, wild biota and economic activities, and economics and extinction. A concluding chapter suggests several complimentary approaches to global conservation.

Owen, Oliver S., Natural Resource Conservation - An Ecological Approach, Macmillan Publishing, New York, 4th ed., 1985, 657 pp.

A compact overview of this area of research with helpful illustrative materials that support a text studded with facts related in an engaging manner.

Pacey, Arnold, The Culture of Technology, The MIT Press, Cambridge, MA, 1983, 200 pp.

Demonstrates how inherently "value-laden" technology is by looking at our attitudes toward nuclear weapons, biotechnologies, pollution, Third World development, automation, social medicine, and industrialization.

Park, David, The How and the Why - An Essay on the Origins of Development of Physical Theory, Princeton University Press, Princeton, 1988, 459 pp.

A history of ways in which people have thought about and attempted to explain the physical world. Grouped around major themes within the currents of thought over the centuries, discussions of all major physical theories can be found in these pages including recent quantum theory and

speculation. A series of technical appendices mathematically clarifies text discussion and a large bibliography promotes extended reading on topics of interest.

Penzias, Arno, Ideas and Information: Managing in a High-Tech World, W. W. Norton, New York, 1989, 224 pp.

A Nobel Prize winner in Physics and Vice-President of AT & T's Bell Labs, demystifies the computer and describes both the possibilities and limitations of this pervasive symbol of modernity. A series of engaging stories and research vignettes enlivens this rich and thoughtful account.

Perrow, Charles, Normal Accidents - Living with High-Risk Technologies, Basic Books Inc., New York, 1984, 386pp.

A member of the President's Commission on the Three Mile Island accident, this sociologist examines how and why catastrophic accidents occur in high-tech industries (nuclear power, petrochemical, and aerospace) and argues that they are becoming nearly inevitable in our advanced technological society. The author believes current risk assessment (RA) theory is seriously flawed and techniques supported by results of RA are often the most dangerous in light of considerations not within the purview of RA. Above all, the book argues that "sensible living with risky systems means keeping the controversies alive, listening to the public, and recognizing the essentially political nature of RA. Ultimately, the issue is not risk, but power; the power to impose risks on the many for the benefit of the few".

Porter, Alan L., Frederick A. Rossini, Stanley R. Carpenter, A. T. Roper, with Ronal W. Larson, Jeffrey S. Tiller, A Guidebook for Technology Assessment and Impact Analysis, North Holland, New York, 1980, 510 pp.

The first complete description of technology assessment (TA) including both the "how to" and reflections about the purposes and limitations of the process. Both environmental impact analysis (EIA) and TA are presented. Topics include: basic features and strategies for assessments; technology and social context descriptions and forecasting; impact identification; analysis and evaluation; environmental, economic, social, and institutional analysis techniques; policy analyses; communication of results; project management; and evaluation of TA/EIA.

Pursell, Carroll W. Jr., Ed., Technology in America - A History of Individuals and Ideas, The MIT Press, Cambridge, MA, 1981, 264 pp.

Biographic essays by leading scholars of 20 American technologists including ones on Benjamin Latrobe, Thomas P. Jones, James Buchanan Eads, James B. Francis, Ellen Swallow

Richards, Morris L. Cooke, as well as the more familiar Thomas Edison, Eli Whitney, Cyrus McCormick, Alexander Graham Bell, Henry Ford, Charles Lindberg, Enrico Fermi, and Robert Goddard.

Pytlik, Edward, Donald P. Lauda, David L. Johnson, Technology, Change and Society, Davis Publications, Worcester, MA, rev. ed., 1985, 297 pp.

An introductory college text that helpfully overviews technology and its impact on the modern world.

Regens, James L., Robert W. Rycroft, The Acid Rain Controversy, University of Pittsburgh Press, Pittsburgh, 1988, 228 pp.

The authors synthesize the existing answers to common questions about acid rain, and the points of consensus and debate about them within the scientific community, as a basis for evaluating policy decisions. A comprehensive review of pollution control techniques includes whether each technology is currently available, potentially available in the next ten to fifteen years, or merely theoretically possible from an engineering standpoint. They suggest that the lesson of the acid rain experience is that any policy response to this issue, or other pressing environmental issues, will inevitably be carried out within the context of scarce economic resources, highly charged political tradeoffs, and scientific uncertainty.

Repetto, Robert, & Malcolm, Gillis, Eds., Public Policies and the Misuse of Forest Resources, Cambridge University Press, New York, 1988, 432 pp.

Nine major essays by several authors explore public policies, forest resource management, and deforestation in Indonesia, Malaysia, the Philippines, China, the Amazon, West Africa, and the U.S. Principal findings from these cases are then summarized and suggestions for improving the policy environment for utilization of natural forests are presented.

Rybczynski, Witold, Taming the Tiger - The Struggle to Control Technology, The Viking Press, New York, 1983, 247 pp.

An excellent book that discusses technology in the modern world with attention to the tensions that technologies have produced over historical time. Numerous, well-chosen examples reinforce the main arguments from this innovative Canadian architect, designer, and savant.

Salvaggio, Jerry L., Ed., Telecommunications - Issues and Choices for Society, Longman, New York, 1983, 182 pp.

A set of ten essays by various authorities regarding the nature of information societies and public policy for an information society. Critical issues such as the First

Amendment and the information society, the social impact of telecommunications, life in the electronic future, monopoly versus competition, and the social effects of media convergence are explored.

Schnaars, Steven P., Megamistakes - Forecasting and the Myth of Rapid Technological Change, The Free Press (Macmillan), New York, 1989, 202 pp.

This compelling analysis of forecasts made over the past three decades identifies the most common errors in forecasting and provides sound guidelines for entrepreneurs, managers, and forecasters. "Technological wonder", Schnaars argues, has often seduced people into megamistakes with forecasters optimistically predicting changes at breathtaking speeds while failing to consider commonsense economics and marketing considerations. Basic, fundamental questions, the author argues, should take precedence over complex analyses.

Shinn, Roger L., Forced Options - Social Decisions for the 21st Century, Harper and Row, San Francisco, 1982, 267 pp.

A helpful book by a prominent theologian which tackles key scientific and technologically related social issues facing the modern world. A number of different scenarios for each issue is portrayed with a focus on the importance of thoughtful societal choices of the direction we should take as societies in light of the exigencies posed.

Singleton, Laurel R., Science, Technology, Society Training Manual, Social Science Education Consortium, Inc., Boulder, CO, 1988, 164 pp.

A handy resource to use when giving in-service workshops concerning STS education. Chapter titles are: Introduction (focusing on the importance of STS), designing a training program, introducing STS, fitting STS into the curriculum, implementing STS, and evaluating STS programs. A set of transparency masters, teaching strategies, and a list of other resources available from SSEC finishes the volume.

Slater, Robert, Portraits in Silicon, The MIT Press, Cambridge, MA, 1987, 374 pp.

Thumbnail sketches of 31 people who are generally mentioned by their peers as the masterminds of the computer revolution. Designers, hardware engineers, entrepreneurs, and software writers are all represented as well as some key early workers. Useful explanations of devices and techniques are interwoven with biographical facts and insights into what motivated these pioneers.

Soule, Michael E., Ed., Conservation Biology - The Science of Scarcity and Diversity, Sinauer Associates Inc., Sunderland, MA, 1986, 584 pp.

Twenty-five essays by experts consider a wide range of topics relevant to in situ and ex situ conservation under the general headings of the fitness and variability of populations, patterns of diversity and rarity, the effects of fragmentation, community processes, sensitive habitats, and interacting with the real world. An extensive bibliography and index made the book useful to both student and professional.

State of the Environment: A View Toward the Nineties, The Conservation Foundation, Washington, D.C., 1987, 614 pp.

Two large sections - status and trends/issues - present a smorgasbord of information supported by a very large number of graphs, charts, and figures. This is arguably the best one volume treatment on the subject of the American environment in print with copious footnotes to primary literature, an extensive index, and a clear, concise executive summary.

Staudenmaier, John M., Technology's Storytellers - Reweaving the Human Fabric, The MIT Press, Cambridge, MA, 1985, 282 pp.

A fine study of the emergence of the history of technology as an intellectual discipline using the 272 articles published in Technology and Culture from its inception through 1980. He looks for consensus both in outlook and the period of time selected for study. Three recurrent themes are identified: emerging technology, the relationship between science and technology, and the cultural ambience of technology.

Strom, Margaret A., Ed., Societal Issues - Scientific Viewpoints, American Institute of Physics, New York, 1987, 240 pp.

Fifty short readings from the pens of such noted scientists and engineers as Samuel Florman, Robert C. Wilson, Victor Weisskopf, Hans Bethe, Linus Pauling, Andrei Sakharov, Jay Forrester, George Wald, James Van Allen, Glenn Seaborg, Maxine Singer, and Amitai Etzioni. A wide range of issues are discussed in physics, engineering, astronautics, and related disciplines as they bear upon society as a whole.

Teich, Albert H., Ed., Technology and the Future, St. Martin's Press, New York, 4th ed., 1986, 394 pp.

A set of twenty-one essays from various persons and sources considers aspects of technology theoretically as well as from a practitioner standpoint. Main foci are the forecasting, assessment and control of technology, ways in

which technology might be reshaped, and ways in which technology is used by society at large to deal with pressing social and political situations.

Volti, Rudi, Society and Technological Change, St. Martin's Press, New York, 1988, 279 pp.

A clearly written exposition that considers what technology can and cannot do, the process of technological change, how technology has transformed work, communication, and warfare, and ways in which technology can be controlled. A reading list enables interested readers to explore topics of interest in greater depth.

Wenk, Edward Jr., Tradeoffs - Imperatives of Choice in a High-Tech World, The Johns Hopkins University Press, Baltimore, 1986, 238 pp.

Wenk argues for greater citizen control over technology since politicians are concerned only with the immediate future. The concept of "tradeoffs" is explored as a tool to aid and guide citizenship decision-making and action. Long term rather than short-term consequences of technology are emphasized.

Williams, Trevor I., The History of Invention: From Stone Axes to Silicon Chips, Facts on File Publications, New York, 1987, 352 pp.

A beautiful book, by a distinguished British historian of science and technology, that tells how each technological innovation met a critical need while creating the demand and the opportunity for the next breakthrough. Thousands of inventions are chronicled, explained, and placed in their historical, cultural, and scientific context in this vivid and comprehensive account of technology.

Winner, Langdon, The Whale and the Reactor - A Search for Limits in an Age of High Technology, The University of Chicago Press, Chicago, 1986, 200 pp.

In a style both personal and philosophical, Winner explores political, social, and philosophical implications of technology. He demonstrates that choices about the kinds of technical systems we build and use are actually choices about who we want to be and what kind of world we want to create. Winner argues that technical decisions are political decisions, involving profound choices about power, liberty, order, and justice.

Woodman, William F., Mack C. Shelley II, Brian J. Reichel, Eds., Biotechnology and the Research Enterprise: A Guide to the Literature, Iowa State University Press, Ames, IA, 1989, 358 pp.

Brief introductions and extended, annotated bibliographies cover the following topical areas: federal-research policy, university-industry relationships, conflicts of interest, university research, the biotechnology industry, international biotechnology research, related issues in biotechnology, and a directory of biotechnology organizations. The section on related issues in biotechnology covers the areas of public perceptions, ethical implications, economic impacts, and historical perspectives - all of which are pertinent to STS education. Appendices of recommended publications and a glossary of biotechnology terms complete this worthwhile reference.

Worster, Donald, Rivers of Empire - Water, Aridity, and the Growth of the American West, Pantheon Books, New York, 1985, 402 pp.

Worster's study shows how, from the earliest days of Western development, elites of wealth and technological power have controlled the American West's most precious resource - water. In a reinterpretation of the region's history, Worster demonstrates that the West can be seen as a modern hydraulic society, completely dependent upon its dams, reservoirs, and canals. The price we have paid for chasing the dream of a "garden that would bloom in the desert" is graphically portrayed.

Yearley, Steven, Science, Technology and Social Change, Unwin Hyman, Boston, 1988, 199 pp.

Ideas from the latest research in the sociology and politics of science are used to address three issues: the nature of scientific knowledge and the authority it commands; the political and economic role of science in the West; and the relationship of science, technology, and social change in underdeveloped nations. Topical examples, ranging from nineteenth-century brain science to the strategic defense initiative, are used to illustrate themes that emerge from the study of these three issues.

Ziman, John, Teaching and Learning about Science and Technology, Cambridge University Press, New York, 1980, 181 pp.

An attempt to furnish a rationale for STS education. Ziman includes in the discussion such factors as the sociology and philosophy of science and education, political ideologies, vocational needs, and scholarly standards. The entire discussion is sensitive to the teaching/learning environment although the focus is on British schooling.

STS IN RECENT PERIODICAL LITERATURE

Abbott, Jane (1987). STS and secondary education. Bulletin of Science, Technology & Society, 7(5/6), 785-789.

Aikenhead, Glen S. (1985). Collective decision making in the social context of science. Science Education, 69(4), 453-476.

Aikenhead, Glen S. (1987). High-school graduates' beliefs about science-technology-society. Characteristics and limitations of scientific knowledge. Science Education, 71, 459-487.

Aikenhead, Glen S. (1988). An analysis of four ways of assessing student beliefs about STS topics. Journal of Research in Science Teaching, 25(8), 607-630.

Bredderman, Ted (1987). A technology strand in elementary science: is it defensible? Bulletin of Science, Technology & Society, 7(1/2), 218-224.

Brinckerhoff, Richard F. (1985a). An experimental method for infusing STS into secondary school curricula. Bulletin of Science, Technology & Society, 5(2), 130-137.

Brinckerhoff, Richard F. (1985b). A new technique for teaching societal issues. Journal of College Science Teaching, 14(6), 475-479.

Brunkhorst, Bonnie J. (1987). Exemplary middle and junior high science programs: student outcomes in knowledge, attitudes and STS applications. Bulletin of Science, Technology & Society, 7(5/6), 813-824.

Brunkhorst, Herbert & Yager, Robert E. (1986). A new rationale for science education - 1985. School Science and Mathematics, 86(5), 364-374.

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MAJOR CURRICULUM REFORM DOCUMENTS SUPPORTING AN STS APPROACH

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SELECTED STS LITERATURE IN THE ERIC SYSTEM, 1983-1988

(Special thanks to Dr. John J. Patrick of ERIC/CheSS for his generous assistance.)

ED293705 - Leonard J. Waks, Ed., Proceedings of the Second National Science, Technology and Society (STS) Conference, Washington, DC, February 6-8, 1987, Bulletin of Science, Technology, & Society, 7(1/2), 374 pp. (contains 59 papers from the conference grouped under six general themes).

ED293690 - Uri Zoller, et al., "Goals' Attainment in Science-Technology-Society (S/T/S) Education: Expectations and Reality. A Probe into the Case of British Columbia", 1988, 25 pp. [A study of the effects of the course Science and Technology 11 (ST11) in the schools of British Columbia, Canada].

ED293214 - Leonard J. Waks, "Science, Technology, and Society - Education and Citizen Participation", 1988, 28 pp., Center for Philosophy and Public Policy, The University of Maryland, College Park. (A philosophically oriented position paper).

ED292688 - Patricia E. Blosser, Stanley L. Helgeson, Eds., Abstracts of Presented Papers at the National Association for Research in Science Teaching Annual Conference, April 10-13, 1988, 186 pp. (STS is one subject area covered in the abstracts).

ED292668 - Genzo Nakayama, "Reform of School Science Curriculum for the 21st Century: Science-Technology-Society Theme in Japanese Context, 1988, 40 pp. (paper presented at NSTA Annual Meeting, April 7-10, 1988 overviewing STS efforts in Japan).

ED292665 - David Layton, Ed., Innovations in Science and Technology Education, Vol. 1, UNESCO, Paris, 1986, 188 pp. (Richard F. Schumway, "Science, technology and society: educational implications" and Albert V. Baez, "Science, technology and society courses: problems of implementation in school systems").

ED292641 - Robert E. Yager, et al., "Assessing the impact of S/T/S instruction in 4-9 science in five domains", 1988, 15 pp. (Some results of assessment in 300 Iowa classrooms and shown and discussed. Documents that students taking STS are better able to make applications and connect experiences to other areas of life).

ED292626 - Robert E. Yager, "Assessing the impact of the Iowa Honors Workshop on science teachers and students. A final report for NSF. With appendices". 1988, 567 pp. (Component

of workshop was STS, includes data and analysis of in-school assessment regarding STS, types of materials produced, and other pertinent information).

ED292608 - John F. Disinger, comp., Trends and Issues in Environmental Education: EE in School Curricula. Reports of a Symposium and a Survey, 1987, 149 pp. (Contains a survey of EE in 40 states, numerous papers including one by Peter A. Rubba, "An STS perspective on environmental education in the school curriculum").

ED292427 - Phyllis O'Callaghan, Ed., A Clashing of Symbols: Method and Meaning in Liberal Studies, Georgetown University Press, Washington, DC, 1988, 156 pp. (13 essays about interdisciplinary graduate liberal studies programs including one by Thomas P. McManus, "Science, Technology, and Society").

ED289737 - Louis A. Iozzi, Science-Technology-Society: Preparing for Tomorrow's World. Teacher's Guide. A Multidisciplinary Approach to Problem-Solving and Critical-Thinking, Sopris West Inc., Longmont, CO, 1987, 40 pp. (Part of a junior high/middle school program in STS. The entire series is being revised by Sopris West and should be available within the year. Other numbers in the series within ERIC are ED289736, ED289735).

ED288783 - Faith M. Hickman, et al., Science/Technology/Society: A Framework for Curriculum Reform in Secondary School Science and Social Studies, Social Science Education Consortium Inc., Boulder, CO, 1987, 56 pp. (Explores the STS theme and gives general guidance in preparing curriculum and identifying appropriate instructional strategies).

ED287794 - John J. Patrick, Connecting Science and Free Government in Citizenship Education: Teaching About our Legacy from the Age of Enlightenment, 1987, 16 pp. (paper presented at the Conference on STS in the Secondary School Curriculum, November 6, 1987 at Winooski, VT).

ED282711 - John F. Disinger, Marylin Lisowski, Teaching Activities in Science/Society/Technology/Environment, ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, OH, 1986, 164 pp. (Activities for grades 1-12 along with general references and a rationale for the role and importance of EE in STS).

ED281709 - John F. Disinger, comp., Current Practices in Science/Society/Technology/Environmental Education: A Survey of the State Education Agencies, ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, OH, 1986, 127 pp. (Results of a national survey carried out in 1986 designed to identify and characterize elementary and secondary school programs at local and state levels regarding the status of STS and EE. Forty states and the D.C. responded).

ED280739 - NSTA, "Criteria for Excellence. An NSTA Science Compact", 1987, 41 pp. (details criteria for the various areas of NSTA's Search for Excellence program, one at the secondary level focused on STS and components of STS at elementary and middle school levels).

ED280715 - Patricia E. Blosser, Stanley L. Helgeson, Eds., National Association for Research in Science Teaching Annual Conference, Abstracts of Presented Papers, Washington, DC, April 23-25, 1987, 206 pp. (Includes papers in the area of STS)

ED280673 - Robert K. James, Ed., Science, Technology and Society: Resources for Science Educators, SMEAC Information Reference Center, Columbus, OH, 1986, 150 pp. (The 1985 Association for the Education of Teachers in Science Yearbook with eleven papers grouped into three thematic sections).

ED279556 - Paul B. Otto, "Don't overlook writing as an activity in the elementary science classroom", 1987, 11 pp. (consists of specific activities for classroom use including some dealing with STS themes. Sources of additional ideas of writing activities are also identified).

ED278610 - Charles S. White, "The role of the secondary social studies curriculum in developing technological literacy", 1987, 14 pp. (paper presented at the Second National Technological Literacy Conference, Washington, DC, February 6-8, 1987).

ED278609 - Gerald W. Marker, "Including science/technology/society issues in elementary school social studies: can we? should we?", 1987, 20 pp. (paper presented at the Second National Technological Literacy Conference, Washington, DC, February 6-8, 1987).

ED277558 - E. J. Wenham, Ed., New Trends in Physics Teaching, Volume IV, UNESCO, Paris, 1984, 373 pp. (the last part of this book deals with recent ideas on STS education with discussions of physics in society and appropriate technology).

ED277547 - John F. Disinger, Terry L. Wilson, "Locating the 'E' in S/T/S", ERIC/SMEAC Information Bulletin, No. 3, 1986, 7 pp. (emphasizes the similarities between discussions of STS in science and social studies and discussions in EE. Suggests ways in which individuals and organizations within these groups can work together for common goals).

ED275552 - Glen S. Aikenhead, et al., "Research methodologies for monitoring student viewpoints", 1985, 31 pp. (paper presented at annual meeting of NARST, March 28 - April 1, 1986 which describes development of the instrument and

results from the "Views on Science-Technology-Society (VOSTS)" assessment of over 10,800 Canadian graduating high school students).

ED274555 - Michigan State Board of Education, Essential Performance Objectives for Science Education, Grades K-9, Lansing, MI, 1986, 55 pp. (includes STS as one of seven major sections for goals and objectives with coverage of each subtopic and topic for grades K-12 given and keyed as introductory, developmental, or reinforcement).

ED274513 - Marylin Lisowski, "Science-Technology-Society in the science curriculum", ERIC/SMEAC Special Digest, No. 2, 1985, 3 pp. (Provides brief rationale, goals, instructional approaches, programs at U.S. and international levels, and selected publications of value).

ED273487 - Edward P. Donovan, Science Proficiencies and Competencies for Students in Grades Eight Through Twelve, Moorestown Township School District, NJ, 1986, 82 pp. (completed in 1982-83, the document's seven sections include one focused on science education's role as the link between science, technology, and society).

ED273454 - Aart DeKorte, "Science education in our time: the need for an interdisciplinary approach", 1985, 20 pp. [presents the interdepartmental course at Fairleigh Dickerson University on Science in a Cultural Context (SCC) for science majors and non-majors].

ED271327 - Kenneth W. Dowling, et al., A Guide to Curriculum Planning in Science, Wisconsin State Department of Public Instruction, Madison, WI, 1986, 190 pp. (includes a section on STS for each of the following grade levels: K-2, 3-6, middle/junior, and senior high).

ED270039 - The State University of New York: The New Liberal Arts Curriculum in Transition. Selected papers from Six SUNY Conferences (June 1984 - September 1985), 1986, 68 pp. [includes two useful papers on STS, "Ethics and values in science and technology: the price of success" (Charles O. Warren) and "Why science, technology and society courses should be society, technology, and science courses; or why tails shouldn't wag dogs" (Robert Keesey)].

ED269257 - David L. Elliott, Kathleen Carter Nagel, "Scientific illiteracy in elementary science textbook programs", 1986, 19 pp.(Paper presented at annual AERA meeting, April 16-20, 1986. Nine elementary science textbook series and one non-textbook program were examined for content related to several areas including STS and found seriously wanting).

ED269249 - Program Descriptions for Science Instructional Materials, California State Department of Education, Sacramento, 1986, 63 pp. (Detailed descriptions of state-adopted elementary programs and texts, each program description includes a section on STS).

ED267993 - Reg W. Fleming, "Undergraduates studying science: views on STS of future scientists and non-scientists", 1986, 24 pp. (Paper presented at annual meeting of NARST, March 28 - April 1, 1986. Data from a 6 month field study in a chemistry department of a Canadian university using a variation of the VOSTS instrument).

ED266941 - David Layton, Ed., Studies in Science Education, Vol. 9, 1982, 183 pp. [An international review of research published in serial form. This issue includes the following articles on STS: "Teaching about science, technology, and society at the secondary school level in the United States. An educational dilemma for the 1980s" (Mary C. McConnell), "Science, technology and society: issues for science teachers" (P. James Gaskell), and "Science education for citizens: perspectives and issues, II: 'Science and technology policy and the democratic process" (Dorothy Nelkin)].

ED266696 - "Founders' Weekend: North Country Workshop on Science, Technology and the Undergraduate Curriculum. Proceedings, Potsdam, NY, November 9-10, 1984", 55 pp. (Contains an excellent summary of STS at the college level by Stephen Cutcliffe titled :Science, technology and the undergraduate curriculum: where are we nationally?". Several other papers contain information of interest to STS educators).

ED265025 - Elementary Science: Alaska Curriculum Guide, first edition, Alaska Department of Education, Juneau, 1985, 91 pp. (includes objectives and topics related to STS).

ED265014 - Paul E. Bell, "Staff development models using the STS approach for content renewal", 1985, 25 pp. (paper presented at annual NSTA convention, April 19, 1985).

ED264137 - Science, Technology and Society. Block J. Science Syllabus for Middle and Junior High Schools, New York State Education Department, Albany, 1985, 88 pp. (concepts and understandings in four areas dealing with STS, program objectives, 23 science processes keyed to 56 activities).

ED262962 - Regents Competency Testing Program in Science. A Guide to the Core Process Skills and Content Understandings. Information Bulletin, New York State Education Department, Albany, 1985, 32 pp. (Survey test of core process skills and content understandings from the 10 blocks (A through J) of the "Science Syllabus for Middle and Junior High Schools" - note: Block J deals with STS).

ED253467 - John J. Patrick, Richard C. Remy, "Science-related social issues: challenges for the social studies", ERIC Digest, no. 16, 1984, 4 pp. (background, rationale, and promising practices for teaching about science-related social issues in science and social studies classes).

ED253421 - Physics 200, 300 Interim Guide, Manitoba Department of Education, Winnipeg, Canada, 1984, 373 pp. (Physics 300 deals with topics that includes alternative energy sources and STS).

ED251389 - John J. Patrick, Richard C. Remy, Connecting Science, Technology, and Society in the Education of Citizens, Social Science Education Consortium, Boulder, CO, 1985, 97 pp. (links STS education to education for citizenship in a democracy, provides rationale and specific strategies).

ED249078 - Mary C. McConnell, et al., Television. Innovations: The Social Consequences of Science and Technology Program, Kendall/Hunt Publishing Company, Dubuque, IA, 1984, 91 pp. [Part of the BSCS "Innovations" series of modules for high school students. Other titles within the ERIC system include "Science, Technology and Society" (ED249077), and "Human Reproduction" (ED249076), "Computer and Privacy" (ED249075), and "Biomedical Technology" (ED249074)].

ED249054 - Alfred T. Collette, Eugene L. Chiappetta, Science Instruction in the Middle and Secondary Schools, C. V. Mosby Co., St. Louis, MO, 1984, 632 pp. (a college methods textbook for preparation of science teachers which includes a chapter on the implications of STS for science teaching).

ED247095 - Science for Every Student: Educating Canadians for Tomorrow's World. Summary of the Report, Science Council of Canada, Ottawa, Ontario, 1984, 28 pp. (Summary of the four year Science Council of Canada study in Canadian elementary and secondary schools. The first section argues for science education in an STS framework, the third section discusses the importance of STS in the science curriculum).

ED243666 - Graham W. F. Orpwood, Jean Pascal Souque, Science Education in Canadian Schools. Volume I. Introduction and Curriculum Analyses. Background Study 52, Science Council of Canada, Ottawa, 1984, 218 pp. (Part three examines the role of textbooks in science education and examines the content of 32 texts for a number of features including STS and images of science conveyed in textbooks. STS in these texts was found to be notably absent).

ED239846 - Richard A. Tolman, Innovations: The Social Consequences of Science and Technology. Final Evaluation Report, BSCS, Boulder, CO, 1981, 24 pp. (findings indicate that units were enthusiastically received by students and teachers and that, as a result of formative evaluation data

collected, information was provided for revising the experimental modules to produce a commercially available product).

ED230431 - John R. De la Mothe, "Unity and diversity in STS curricula", 1983, 6 pp. (a brief overview of the types of STS curricula in place in U.S. colleges and universities).

ED230388 - Louis A. Iozzi, Curriculum Model. Teacher's Guide. Preparing for Tomorrow's World, Sopris West Inc., Longmont, CO 80501, 1982, 34 pp. [presents a rationale and curriculum development model that was used in developing this STS course. Modules within the series available through the ERIC system include "Technology and Society: A Futuristic Perspective" (ED230387, ED230386), "Technology and Changing Lifestyles" (ED230385), "Space Encounters" (ED230383), "Perspectives on Transportation" (ED230382), "People and Environmental Changes" (ED230379), "Of Animals, Nature and People" (ED230378), "Future Scenarios in Communications" (ED230375), "Environmental Dilemmas: Critical Decisions for Society" (ED230374), "Energy: Decisions for Today and Tomorrow" (ED230372), "Dilemmas in Bioethics" (ED230370), "Coastal Decisions: Difficult Choices" (ED230368), and "Beacon City: An Urban Land Use Simulation" (ED230367)].

ED229255 - "Toward the Desired State in Science Teaching. Proceedings of Annual Curriculum Update Conference, June 21-26, 1981, Iowa University Science Education Center, 61 pp. [focused discussion upon the results of Project Synthesis and comparison of the ideal versus the actual state of science education in the five major areas of Project Synthesis, one of which is STS].

ED220281 - Teaching Middle Grades Science, Georgia State Department of Education, Atlanta, 1982, 81 pp. (the first section provides a rationale for an STS emphasis in middle school science).

SELECTED STATE EDUCATION DOCUMENTS WHICH INCLUDE STS

Colorado Department of Education, Science Curriculum Workbook, Denver, n.d., 93 pp. (The overall intent of the workbook is to allow each district to create its own timing of when selected concepts are introduced into K-12 levels. Section 5 deals explicitly with STS and suggests concepts in 14 sub-areas including energy, technology, communications, computer technology, petroleum, consumer education, and safety. Section 3 also includes some items related to values in science and science education).

District of Columbia Public Schools, Competency Based Curriculum Guide, Science and Social Issues, 1983, 288 pp. (designed for 10-12th grade students as a terminal, credit earning course for students who will not elect to take additional science courses. No prerequisites are required. Focuses on six issues: decision making, urban planning (both community and personal focus), food and nutrition, environmental pollution, nuclear energy, and resource management).

Illinois State Board of Education, Model Learning Objectives - Biological and Physical Sciences, Springfield, 1986, 48 pp. [One of four major outcomes states: "students will have a working knowledge of the social and environmental implications and limitations of technological development". The guide provides model learning objectives for this outcome for all students and then additional objectives for grades 3 (suggests it is not appropriate for this level), grade 6 (26 objectives), grade 8 (46 objectives), and grade 10 (59 objectives).].

Indiana Department of Education, Science Proficiency Guide, June 1987, 34 pp. (A set of suggested proficiencies which "Indiana students should have opportunities to experience if they are to be effective participants in an information-rich society which is increasingly dependent on science and technology". Includes numerous items related to STS for grades K-12).

Indiana Department of Education, Indiana Schooling for the Twenty-First Century, February 1987, Executive Summary (19 pp.), complete document also available from Indiana Dept. of Education, Room 229 State House, Indianapolis, IN 46204 (a product of the Indiana Curriculum Advisory Council of 50 persons which contains several policy sections that argue for greater attention to the average student and his/her need "to know the scientific, technical and cultural dimensions of their existence").

Indiana Department of Education, Indiana's Science Education Challenge for the Twenty-First Century, 1988, c. 18 pp., document available from above address (a subject area document which follows from the mandates of the above report and contains policy statements for science education for

grades K-12. Sections of the report argue for making all students familiar with both science and technology and environmental issues).

State of Florida, Department of Education, Student Performance Standards of Excellence for Florida Schools in Mathematics, Science, Social Studies and Writing: Grades Three, Five, Eight and Twelve, 1984-85 through 1988-89, Bureau of Curriculum Services, State of Florida, Department of Education, Tallahassee, FL 32301, 1984, 97 pp. (A comprehensive set of competency standards and skills for these four curriculum areas with identification of the appropriate grade level by which students should be able to demonstrate the requisite skill. A number of the science and social studies standards and skills relate to STS. A set of 38 science "curriculum frameworks", viz. course outlines, detail objectives which deal with STS in addition to other skill areas).

State of Florida, Department of Education, Minimum Student Performance Standards for Florida Schools, 1986-87 through 1990-91, Beginning Grades 3, 5, 8, and 11 - Computer Literacy and Science, Tallahassee, 1986, 45 pp. (Section K of the Science portion states that "The student will describe the interactions among science, technology, and society" and follows with 17 basic skills).

Maryland State Department of Education, Science - A Maryland Curricular Framework, Baltimore, 1985, 38 pp. (Science and society is explicitly discussed in the philosophy section. The sociology of science is mentioned as subgoal 1.2 with 6 expectancies while STS appears as sub-goal 1.4 with 9 expectancies).

Michigan State Board of Education, Essential Performance Objectives for Science Education, Grades K-9, Lansing, 1986, 52 pp. (Section V deals with STS categories and includes objectives and sequencing for K-3, 4-6, 7-9, and 10-12 in five areas: the relationship of science and technology, technology as a system, the nature of technology, STS problems and solutions, and science and technology interactions. A total of 19 concepts to be taught are enumerated).

Missouri Department of Elementary and Secondary Education, Core Competencies and Key Skills for Missouri Schools, For Grades 2 through 10, September 1986, 165 pp. (Some items related to STS in both the science and social studies portions of this document).

New York State Education Department, Unified Science - Solving Problems in Science, Technology, and Society, The University of the State of New York, The State Education Department, 1987, 137 pp. [A syllabus for the second year in science graduation requirement for New York State schools. Six

issues are presented (environmental decisions, science and crime, disasters, consumerism, food and nutrition, and science, technology and auto safety) with background information, a content outline, key questions, performance objectives, a few activities, and references for each issue].

New York State Education Department, Elementary Science Syllabus, The University of the State of New York, The State Education Department, 1988, 60 pp. (a syllabus that includes many items related to STS in elementary school science including specific attention to science attitudes; problem solving, inquiry, and language arts skills; science content; and program activities).

New York State Education Department, Science, Technology, and Society, Block J - Science Syllabus for Middle and Junior High Schools, The University of the State of New York, The State Education Department, 1985, 49pp. (A syllabus that complete the middle and junior high school science syllabus (A-J) which can be covered in any order. The guide provides program objectives, performance criteria, concepts and understandings, questions and activities, and a list of resources).

Ohio Department of Education, Energy and Resource Conservation, Minimum Standards Leadership Series, 1985, 76 pp. (Designed to assist school districts to meet and exceed the elementary and secondary school standards requirement that "Courses of study shall provide for the following topics to be a part of the curriculum . . . energy and resource conservation". The guide includes a rationale; components and outcomes in terms of lifelong learning skills, concepts and understandings, and ethical behavior; guidelines for choosing activities; teaching strategies; guide to in-service activities; advice regarding using nonschool resources; and references and biographical sketches).

Pennsylvania Department of Education, Recommended Science Competencies Grades 7 through 12 for Pennsylvania Schools, Bureau of Curriculum and Instruction, 1987 (A set of 20 competencies authored by Peter Rubba of Penn State regarding STS education are part of the larger set of competencies. The 20 competencies are grouped into STS foundations, STS issue awareness, STS issue investigation, and STS action skill development).

Utah State Office of Education, Learning Activities for the Core Option Course: Biological-Earth Science, Office of Curriculum and Instruction, rev. ed., 1987, c. 200 pp. (A set of activities keyed to state curriculum standards and objectives. For each laboratory activity there are sections that give materials/preparation, teacher background, procedural, evaluation, and reference information).

Utah State Office of Education, Learning Activities for the Core Option Course: Physical-Earth Science, Office of Curriculum and Instruction, rev. ed., 1987, c. 200 pp. (A set of activities keyed to state curriculum standards and objectives. For each laboratory activity there are sections that give materials/preparation, teacher background, procedural, evaluation, and reference information).

Texas Education Agency, Science Framework, Kindergarten - Grade 12, Austin, 1987, 155 pp. [Several items related to STS, especially at high school level, with general science courses like Biology I and specialized courses like Environmental Science and Marine Science. The Social Studies Framework, Kindergarten - Grade 12 (1986, 78 pp.) also includes STS items in its high school course in World Geography].

Office of the Superintendent of Public Instruction, Guidelines for Science Curriculum in Washington Schools, Olympia, 1985, 88 pp. (Goals 1 and 3 include some sub-goals related to STS. Goal 4 states: "Develop values, aspirations, and attitudes that promote personal involvement of the individual with the environment and society". Five subgoals under #4 include clear STS concepts. The guide gives instructional implications and learner outcomes for each of these subgoals for grades K-3, 4-6, 6-9, and 9-12).

Wisconsin Department of Public Instruction, A Guide to Curriculum Planning in Science, Madison, 1986, 183 pp. (Contains objectives, subobjectives, and example activities for K-2, 3-6, Middle/Junior High, and Senior High divisions with the following explicit subsets for each division within the guide: overview; curriculum development, problem solving, science knowledge, nature of science, science, technology, and society, and evaluation).

SELECTED ELEMENTARY LEVEL STS PROGRAMS AND MATERIALS

Science for Life and Living: Integrating Science, Technology, and Health in Elementary Education, Biological Sciences Curriculum Study, under development. Contact: Dr. Rodger Bybee, Associate Director, BSCS, 830 N. Tejon Street, Suite 405, Colorado Springs, CO 80903 (Now in the pilot stage, this K-6 project emphasizes personal/social goals, problem solving, decision making, and technology in relation to science knowledge and procedures involving health issues. The final version will be published by Kendall/Hunt Publishing Company).

Improving Urban Elementary Science: A Collaborative Approach (K-6), Contact: Karen Worth and Judith Sandler, Education Development Center Inc., 55 Chapel St., Newton, MA 02160 (A program that uses the natural world as an experimental starting point with a focus on critical thinking and problem solving. The final version will be published by Sunburst Communications Inc.).

The Life Lab Science Program: Development of a Comprehensive Experiential Elementary Science Curriculum, Contact: Gary Appel/Lisa Glick, Life Lab Science Program Inc., 809 Bay Avenue, Suite H, Capitola, CA 95010 (A 2-6 grades program available over the National Diffusion Network which uses a garden lab as a key component. A three volume curriculum guide helps teachers to integrate science concepts, nutrition and gardening. The finished version of the program will be published by Addison-Wesley Publishing Company in a joint venture with NSF).

National Geographic Kids Network Project, Contact: Peggy Kapisovsky, Technical Education Research Centers, 1696 Massachusetts Avenue, Cambridge, MA 02138 for the entire project and Monica Bradsher, National Geographic Society, 17th and M Streets NW, Washington, DC 20036 for the products finished to date (Designed to function as supplementary units or the basis of a complete course for grades 4-6, this project utilizes telecommunications to share information with other student groups across America. Students investigate issues of scientific, social, and geographic significance. Two completed units deal with Acid Rain and The Weather Machine).

Conservation for Children, Contact: Marilyn Bodourian, Project Director, Conservation for Children, John Muir Elementary School, 6560 Hanover Drive, San Jose, CA 95129 (Available over the National Diffusion Network, this program for grades 1-6 teachers about interdependency, energy, pollution, recycling, and other conservation concepts. The materials are designed to supplement or replace presently used skill materials in elementary curriculum so that costs are minimal).

Science and Technology, Paul F. Brandwein, et al., Coronado Publishers Inc., San Diego, CA, 1987, 6 volumes (An elementary science curriculum for grades 1-6 with one volume devoted to each grade level. The six subtitles in this series are: Things Around Us, Changes Around Us, Changes We Make, On Planet Earth, Planet Earth in Space, and In A New Age. Designed primarily with awareness of science and technology as a goal rather than the raising of critical social issues, each volume, especially at the upper elementary levels features examples of science and technology in the everyday world).

Technology Infusion Project, Elementary Teaching Materials, The Commonwealth Institute for the Improvement of Science and Mathematics Education, Bureau of Curriculum and Instruction, Pennsylvania Department of Education, Harrisburg, PA, 1984, 167 pp. (A set of fifty-six supplementary activities for science classrooms divided into fifteen major technology topics and spanning grades K-6. Each lesson includes objectives, learning activities, evaluation suggestions, references, reproducible diagrams, glossary materials, and background information).

A Curriculum for Science, Technology, and Society for the Third and Fourth Grade, Contact: Karen Steffen Dallman, 1147 Anchor Drive, Green Bay, WI 54313, 1989, 67 pp. (A teacher made curriculum that contains four units with a total of 14 lessons. The units are acid rain, fluoridation of water supplies, water pollution, and endangered species. A resource list and bibliography complete the module. Each lesson plan includes an objective, method, background information, materials needed, procedure, evaluation, extension, subject area appropriateness, and approximate class time needed).

SELECTED MIDDLE SCHOOL/JUNIOR HIGH SCHOOL PROGRAMS

Interactive Middle-Grades Science, Contact: George Dawson, Florida State University, Science Education Program, Tallahassee, FL 32306-1047 (Designed for grades 6-8, this project addresses STS problems using a multimedia system of instruction and student evaluation, tapping Florida State's expertise in instructional systems design. The finished product will be published by Houghton Mifflin).

Foundational Approaches in Science Teaching, Contact: Donald B. Young, Co-Director, Curriculum Research and Development Group, University of Hawaii, 1776 University Avenue, RM UHS 2-202, Honolulu, HI 96822 (A full year course for 7th grade that has been used successfully in grades 6 and 8. Available over the National Diffusion Network, FAST is laboratory oriented and integrates three strands: physical science, ecology, and relational study. The ecology strand emphasizes plant and animal growth and development, weather

and climate, field mapping, and population sampling. The relational study emphasizes resource management, technology, environmental use, energy use and conservation.).

Wildlife Inquiry through Zoo Education (WIZE), Module II, Survival Strategies, Contact: Annette Berkovits, Curator of Education and Director of Project WIZE, Bronx Zoo, New York Zoological Society, 185th Street and Southern Boulevard, Bronx, NY 10460 (Combines classroom study with the unique scientific resources available at zoos in exploring issues related to wildlife survival in the 21 century. Available over the National Diffusion Network, this program involves students in 15-20 weeks of instruction that equips young people to approach difficult problems analytically and make decisions based on informed perspectives rooted in a firm understanding of complex scientific concepts. It can be used with Module I of the set Diversity of Lifestyles (which explores habitats and survival techniques) for a year long course.

Chemical Education for Public Understanding Program, Contact: Dr. Ronald C. Laugan, Assistant Director, CEPUP, Lawrence Hall of Science, University of California, Berkeley, CA 94720 (This activities based program in modular format is designed to integrate the study of chemical concepts and processes with societal issues. A total of six modules make up the current middle school set. They are titled: Chemical Survey, Determining Threshold Limits, Risk Comparison, Solutions and Pollution, Toxic Waste, and Toxic Trouble in Fruitvale. The final version will be available in a joint arrangement between CEPUP, Addison-Wesley Publishing, and Lab-Aids Inc.).

Connections: A Curriculum in Appropriate Technology for Fifth and Sixth Grades, Joan Melcher, et al., 1980 (Available through the ERIC system as document ED198 005, this program consists of 10 lessons that look at topics like recycling, solar energy, transportation, and nutrition. Each lesson includes teacher background information, class activities, homework, discussion questions, and a brief quiz).

Genes and Surroundings, Biological Sciences Curriculum Study, Kendall/Hunt Publishing Co., Dubuque, IA, 1983, 147 pg. student module, 135 pg. teacher's guide (An instructional program for junior high and middle school students in human and medical genetics. Five organizing themes are used to group 25 activities: individuality, continuity, variability in relation to others, variability in time, and adaptation. Societal issues are frequently raised in the material and extensive use of resources outside the classroom is required for program success).

Technology Infusion Project, Middle School/Junior High School Teaching Materials, The Commonwealth Institute for the Improvement of Science and Mathematics Education, Bureau of Curriculum and Instruction, Pennsylvania Department of Education, Harrisburg, PA, 1984, 142 pp. (Forty-six supplementary activities for the science classroom divided into fifteen major technology topics. Lessons include objectives, reproducible diagrams, references, glossary, materials needed, and background information).

The Use of Vertebrate Animals in Biomedical Research and Product Testing, Steven W. Baier, Emmaus High School, 851 North Street, Emmaus, PA 18049, 110 pp. (Designed to provide students with both the necessary content to analyze the issues and a framework to assist the student in understanding the role of both personal and societal values and attitudes as they affect science and technology. The two week unit consists of extensive teacher background reading material, a list of useful references, and six activities written for junior high school students that can also be adapted for older pupils.

Investigating and Evaluating Environmental Issues and Actions Skill Development Modules, Harold R. Hungerford, Ralph A. Litherland, R. Ben Peyton, John M. Ramsey, Trudy L. Volk, Stipes Publising Company, Champaign, IL, rev. ed., 1988, 243 pp. (A bound set of six modules, earlier editions of which were identified as an example of an exemplary innovative science program by NSTA. The six module titles are: Environmental Problem Solving; Getting Started on Issue Investigation; Using Surveys, Questionnaires, and Opinionnaires in Environmental Investigations; Interpreting Data from Investigations; Investigating an Environmental Issue; and Environmental Action Strategies. A teacher's guide concludes the volume. The overall program is predicated on a large body of research in environmental education that suggests that student behaviors towards the environment can be changed by effective engagement in environmental issues and actions through application of a four tiered instructional approach.

Science and Technology: Investigating Human Dimensions, Contact: Rodger Bybee, Associate Director, BSCS, 830 North Tejon Street, Suite 405, Colorado Springs, CO 80903. (An NSF funded project to develop and publish through Kendall/Hunt Publishers, a middle school program. One of the major project goals is to "improve middle school students' knowledge and understanding of how science and technology relate to their lives").

Transportation, Energy, and Power Technology, Anthony B. Schwaller, Delmar Publishing Inc., New York, 1989, 417 pp.

A comprehensive high school text with integrated chapter activities. The focus is on explanation of basic concepts and principles of the respective technologies rather than the social implications. Underlying scientific and mathematical concepts supporting transportation, energy, and power are presented in conjunction with the technological content.

Technology and Global Issues: Social Studies for the 21st Century, Contact: Dennis Lichty, Social Studies Consultant, State Department of Education, P. O. Box 9498, Lincoln, NE 68507 (a project underway to develop an STS-oriented social studies course for Nebraska public schools).

Chemistry in the Community, American Chemical Society, Kendall/Hunt Publishers, Dubuque, IA, 1988, student text 518 pp., teacher's guide 429 pp. (A high school chemistry text that has already been adopted in 11 states with significant sales in 40 others. Specific units deal with water resources, conserving chemical resources, petroleum, food, nuclear chemistry, air quality, chemistry and health, and the chemical industry. A comprehensive teacher's guide accompanies the textbook. Laboratory activities are integrated in the text.).

Understanding Technology, R. Thomas Wright, Howard Bud Smith, Goodheart-Willcox Company, South Holland, IL, 1989, 288 pp.

A standard, full-color textbook for high school students that comprehensively discusses resources and technology, technological systems, and technology and society. Thirteen integrated laboratory activities compliment the text. A glossary of technical terms and an index complete the volume.

Innovations: The Social Consequences of Science and Technology, Biological Sciences Curriculum Study, Kendall/Hunt Publishers, Dubuque, IA, 1981 (5 modules with accompanying teacher's guides that cover the following topics: computers and privacy; science, technology and society: an introduction; biomedical technology; human reproduction; and television. Paper-pencil activities compliment readings with discussion questions).

Science and Technology in Society, Association for Science Education of Great Britain, 10 volumes, 1986, 1988, available in the U.S. from The American Chemical Society, Office of Precollege Science, Room 806, 1155 Sixteenth Street, NW, Washington, DC 20036 for $219 for the set plus teacher's guide (A set of 100 free-standing lessons produced

in Britain for insertion into existing science courses. Each lesson includes a brief reading, graphs or diagrams (where needed), discussion questions, and often hands-on activity. Some examples of lessons are: physics in playgrounds, fluoridation of water supplies, looking at motor oil, ball games, acid rain, what are the sounds of music?, AIDS, which bleach?, and as safe as houses.).

Science and Social Issues, District of Columbia Public Schools, Washington, DC, 1983 [Seven units with a list of objectives and suggested activities for each. Topics covered are decision making, urban planning(2), food and nutrition, controlling environmental pollution, nuclear energy, and resource management. Sufficient information about obtaining free and inexpensive materials is provided to enable a teacher to design an activity oriented approach to each issue].

Science, Technology, and Society, Department of Defense Dependents Schools, rev. ed., 1987. Contact Earl Morse, Science Coordinator, DoDDS-Germany Region, APO, NY 09633-0005 (A set of 10 activity oriented modules for grades 9-12 that cover the following topics: population dynamics, biomedical technology, energy, extraterrestrial settlements, health, human space, species extinction and endangerment, transportation, water and civilization, and consumerism).

Modular Science/Technology/Society, Modular - Science/Technology/Society Inc., Wausau, WI, 1986 (a project of the Wausau School District for ninth grade students. Six modules covering skills, food, water, air, sunshine, and systems provide for a year long integrated science course with STS flavor. Paper modules or a computer disk version, with permission to adapt as local needs dictate, make this program especially attractive to schools whose populations are substantially different from the populations for whom these materials were originally developed).

You, Me, and Technology, Agency for Instructional Technology, Bloomington, IN, 1987, distributed by Delmar Publishing, 2 Computer Drive West, Box 15-015, Albany, NY 12212 (Twelve 20 minutes videotapes designed to be used in existing courses in science, technology, and social studies classes along with an activities book and teacher's guide make up this set. A preview videotape that overviews the program is available on loan from Delmar. The twelve programs cover the following topics: consumerism, information processing, four technology revolutions, alternative energy sources, health, agriculture, communications, transportation, technology transfer, population, space exploration, and risk and safety.

Contemporary Issues in Science, Staten Island Continuum of Education, 1982 (A narrative and discussion question guide that looks at the issues of acid rain, radioactive wastes, hazardous wastes, Love Canal, aquifers, cloning, genetic engineering, organ transplants, Laetrile, genetic counseling, and birth control. The guide is available over the ERIC system as document ED228 091).

Creative Role Playing Exercises in Science and Technology, Compiled and edited by Lynn Parisi, Social Science Education Consortium Inc., Boulder, CO, 1986, 756 pp. (Everything needed to do five intensive simulations that deal with the issues of spent nuclear fuel, recombinant DNA research, acid rain, toxic waste, and seabed mining. Handouts and role cards are easily reproduced and cut to distribute to class members. Roles are clearly defined and general conceptual guidance is provided for the teacher. Activities are suitable for science, social studies, technology, or English classes. An annotated list of additional resources enhances the set).

Preparing for Tomorrow's World, Louis Iozzi, et al., Sopris West Inc., Longmont, CO, rev. ed., 1989-1990 (A revision of the original 1982 set of materials developed at Rutger's University and distributed over the National Diffusion Network. Twelve free standing modules make up the set with the first revised module appearing in late spring of 1989. The twelve sets are: Coastal Decisions; Future Scenarios in Communications; Energy Decisions for Today and Tomorrow; Space Encounters; Technology and Changing Lifestyles; Perspective on Transportation; People and Environmental Changes; Of Animals, Nature, and People; Environmental Dilemmas: Critical Decisions for Society; Beacon City: An Urban Land Use Simulation; Dilemmas in Bioethics; and Technology and Society: A Futuristic Perspective).

Energy, Technology and Society, National Energy Foundation, distributed by Bullfrog Films, Oley, PA, September 1989 (A energy education program consisting of five units that explore the sources, uses, and history of energy; solar energy, biomass energy; wind, water, and geothermal energy; and energy and the future. Each kit contains a 350 page Teacher's Resource Book with background notes, lesson plans, worksheets, and detailed model plans, a 45 minute videotape, a computer software package, posters, and an energy file containing up-to-date information on numerous energy sources. Designed for infusion into science or social studies classes).

Teaching Social Issues in the English Classroom, 1985, 215 pp., available from Suzanne Bratcher, Editor, English Department, CU 6032, Northern Arizona University, Flagstaff, AZ 86011 (A special issue of the Arizona English Bulletin edited by Guest Editor Sam Totten. Over 25 contributors provide a collection of rationales and materials for teaching social

issues in the English classroom. Some specific papers include an overview of STS issues in English by Robert Yager and three papers dealing with nuclear issues. An annotated bibliography of over 30 pages of literature grouped by the key social issue addressed concludes the volume).

Basic Genetics: A Human Approach, Biological Sciences Curriculum Study, Kendall/Hunt Publishing Co., Dubuque, IA, 1983, 116 pg. teacher's guide, 119 pg. student module (Designed to teach basic concepts in genetics using human examples rather than other species. Biology "for life and living" is the orientation so that technical terminology is avoided when possible. A consideration of social, ethical, and personal implications of new genetics knowledge and technologies within the context of decision making is a hallmark of this program).

Science/Technology/Society: Model Lessons for Secondary Social Studies Classes, Ed. Robert D. LaRue Jr., Social Science Education Consortium Inc., Boulder, CO, 1988, 218 pp. (36 lessons designed for insertion into existing social studies courses are contained in this notebook. Permission for local reproduction enables a teacher to pick which lessons are appropriate for her classes. Except for the first three lessons which are "attention" activities, all lessons include an introduction, objectives, subject and grade level appropriateness, time required, materials and preparation, procedures, evaluation suggestions, extension and enrichment suggestions, and a list of additional resources. Topics covered include population, water, air, food, war technology, energy, land use, health and disease, hazardous substances, extinction, and mineral resources).

Science/Technology/Society: Model Lessons for Secondary Science Classes, Ed. Janice V. Pearson, Social Science Education Consortium Inc., Boulder, CO, 1988, 216 pp. (35 lessons for science classes. Except for the first three lessons which are "attention activities", all lessons include the format of the model lessons for social studies presented above. A similar range of topics is featured).

Values in School Science: Some Practical Materials and Suggestions, Richard F. Brinckerhoff, Phillips Exeter Academy, Exeter, NH, 2nd ed., 1986, 187 pp. (A collection of brief items designed for quick insertion into existing lessons. Each item is based around a news item in a semi-popular or science periodical source and is designed to raise student awareness of the social implications of scientific endeavors. Permission to xerox material locally is given with purchase of the booklet. A third edition is in preparation).

Contemporary Science: A Curriculum Guide and Student Materials, Ronald T. Truex, Township of Ocean School District, 163 Monmouth Road, Oakhurst, NJ 07755, 1988, 99 pg. curr. guide, 258 pp. student enrichment materials module (Designed for grades 7-12, this curriculum looks at science-related interdisciplinary topics including population, noise pollution, astronomy and meteorology in an STS framework. Four to ten activities are provided for each unit with objectives, materials needed, procedures, and background information. The teacher's guide also includes content outlines, audio-visual aids, references and additional resources, brief summaries of topics, word/phrase content ideas, and suggestions for extension activities).

Science Study Skills Program: People, Energy, and Appropriate Technology, Lisa Smulyan, David Marshak, Eds., National Science Teachers Association, Washington, DC, 1988, student guide of 119 pp, teacher's guide, 162 pp. (Designed to enhance general study skills needed for success in science education, this module adds increased meaningfulness to the effort by focusing on energy and appropriate technology. Examples of the 14 paired study skills with these topics are: 1) solving problems and how much do technologies cost?, 2) using scientific measuring tools and trapping the sun's energy, and 3) making judgments and how does technology affect the environment?

Science in the Marketplace, Florence G. Korchin, Tiger Publications, Red Bank, NJ, 1983, 328 pp. (This text contains 70 lab activities which looks at nutrition, product testing, and energy conservation as it relates to consumerism. Little or no math background is required and all activities are hands-on, using easily obtainable items).

Science and Social Issues, David E. Newton, J. Weston Walch Publishers, Portland, ME, rev. ed., 1987, +150 pp. (Thirty-eight topics address the general areas of biology, physical science, and science as a social institution. Each topic has an introduction, a case study, a question promoting action, additional questions, and a suggested list of readings. The topics can be inserted in existing courses or used alone as the basis for a Science and Social Issues course).

Energy for the Future, John L. Roeder, The Calhoun School, 433 West End Avenue, NY, NY 10024, 1982, +300 pp. (The complete text for a course that has been taught at The Calhoun School for a number of years as the general physical science course. Energy becomes the focus to teach standard physics and chemistry concepts as well as raising key societal issues related to energy. Environmental effects of various energy technologies are brought out and a look toward the future encouraged. A series of integrated laboratory activities provide plenty of hands-on experience. A revised edition is in preparation).

Investigations: Toxic Waste, Educators for Social Responsibility, Cambridge, MA, 1984, 77 pp. (A series of readings and associated laboratory activities on toxic waste. Emphasis upon the local community is encouraged as well as a focus on the national level.

The BONGO Workbook - An Interactive Manual for the Replication of the BONGO Program, Terry Born, Paul Jablon, The ECHO Project, LaGuardia Community College, Long Island City, New York, 1987, 187 pp. (An interdisciplinary program that uses student projects in the creative arts to address learning across the curriculum. STS is a major focus of the integrative nature of the program. The program has been used with particular good effect with at-risk, inner city students and has a proven track record in this arena).

Global Science - Energy, Resources, Environment, John W. Christensen, Kendall/Hunt Publishing Co., Dubuque, IA, 1984, 355 pp. text, 265 pp. lab manual, 370 pp. teacher's guide (An excellent program that looks at such issues as energy and society, energy supply and demand, energy for the future, mineral resources, making peace with our environment, the economics of resources and environment, and options for the future. Seventy-five lab activities provide plenty of investigation of the local environment and the teacher's guide contains everything any teacher would need to get the course up and running).

Focus on Excellence, Vol. 1, No. 5, Science/Technology/Society, Eds., John E. Penick, Richard Meinhard-Pellens, National Science Teachers Association, Washington, DC, 1984, 103 pp. (Ten school-based STS programs identified in NSTA's 1982 "Search for Excellence". Examples are programs focusing on solar energy, environmental science, marine sciences, and unified science).

Technology Infusion Project, Senior High School Teaching Materials, The Commonwealth Institute for the Improvement of Science and Mathematics Education, Bureau of Curriculum and Instruction, Pennsylvania Department of Education, Harrisburg, PA, 1984, 227 pp. (A series of activities designed for science classes at grades 9-12. Each lesson contains objectives, materials required, background information, learning activities, suggested evaluation, references, and illustrative aids. Some activities could be inserted into home economics, social studies, and technology education classes).

Wind, Water, Fire, and Earth - Energy Lessons for the Physical Sciences, National Science Teachers Association, Washington, DC, 1986, 124 pp. [A set of interdisciplinary energy lessons culled from the NSTA Project for an Energy-Enriched Curriculum (PEEC). Each lesson includes background

information, teaching strategies, reproducible student hand-outs, and clearly laid out activities. STS connections are explicit in many lessons and implicit in all].

USA By Numbers, ED. Susan Weber, Zero Population Growth, Washington, DC, 1988, book of 164 pp. plus other materials (A teacher resource kit from ZPG that consists of a bound volume of 13 chapters with statistical tables, maps, and commentaries highlighting demographic socioeconomic, and environmental data, 14 lessons, and a glossary of terms. A number of skills are accessed, especially those relating to chart and graph reading and interpretation. Broader societal issues are explicit in the materials. The lessons could be used in science, social studies, mathematics, or language arts classes).

PLON - Projekt Leerpakketontwikkeling Natuurkunde, contact: PLON, Physics Education Department, State University of Utrecht, PO-Box 80.008, 3508 TA Utrecht, The Netherlands (Tel. 030-532717), 20+ modules (An on-going Dutch science curriculum development effort commenced in 1972 and designed to teach physics in the real world to Dutch students, ages 12-16. The success of the units and international interest has led to the production of some of the modules in English and plans for translation of most of the set. Five modules currently available in English are: Ionizing Radiation, Weather Changes, Traffic and Safety, Bridges, and the simulation "Water for Tanzania". Nearly every module raises broader societal issues related to physics and all are activity/experimentation oriented).

Issues of Technology: Readings and Classroom Activities for Junior High and High School Teachers, Sherry J. Peck, Daniel L. Goldwater, Eds., The Franklin Institute, Philadelphia, PA, 1984, 372 pp. (This resource notebook for teachers includes 28 classroom activities and a variety of related readings from magazines, newspapers, books, and pamphlets. Selected topics in Food Technology, Communications, and Biotechnology are covered by the set. The purpose is to assist students as future citizens to make informed decisions based on an understanding of a given technology, a grasp of its physical and social impacts, and a thorough evaluation of the ethical issues involved).

Science, Technology, Society Communication Chemistry 10,20 and 30 (STSC Chemistry), Frank Jenkins, Ed., Karitann Publishers, 3516 104th Street, Edmonton, Alberta, Canada T6J 2J7, 1987 (A three volume, complete chemistry course for high school which expands upon the earlier ALCHEM project due to the publisher's willingness to be innovative. Clear science, society, technology, and communication emphases can be found throughout the materials including explicit use of a social decision making model and technology evaluation).

Science and Technology 11, Ministry of Education, Schools Department, Curriculum Development Branch, Victoria, British Columbia, 1986, 16 modules, one teacher's notebook (164+ pp), and one instructional resources manual (172 pp). [A program developed to meet the needs of Canadian students but with applicability to students south of the border. The sixteen modules are grouped under three major categories: Personal Connections (health technologies, recreational technology, shelter - technology of the home, and technology for the home), Local/Vocational Connections (the computer in the workplace, forestry, resource management), and Global Connections (telecommunications, transportation, military and defense technology, energy and environmental trade-offs, waste - technology's by-product, food production and distribution, space, and the future). An introductory module to the series completes the set].

Science in a Social Context for Schools, Eds., Sue Addinell and Joan Solomon, 1983, 8 titles and a teacher's guide. Contact: The Association for Science Education, College Lane, Hatfield, Hertfordshire AL10 9AA, England [This series of student booklets is designed to convey the impact of science and technology upon society through a series of problem situations. Titles in the series are: Ways of Living (focused on human interaction with the environment); How Can We Be Sure? (focused on the methods of science and citizen participation in STS issues); Technology, Invention and Industry (case studies on plastics and microelectronics plus general information); Evolution (including social darwinism, eugenics, and related developments); The Atomic Bomb; Energy; Health, Food and Population; and Space, Cosmology and Fantasy].

STUDENT ASSESSMENT INSTRUMENTS AND INFORMATION

STS has not found its way into standardized test instruments in any significant way, although the 1990 Science portion of the National Assessment of Educational Progress will include some items regarding the nature of scientific processes, the nature of values and principles underlying scientific work, and the nature of scientific knowledge (For further information order booklet No. 21-S-10 from NAEP, Educational Testing Service, Rosedale Road, Princeton, NJ 08541). The question of appropriate assessment of STS learning frequently surfaces in curriculum discussions. This section suggests some contacts and sources of information regarding assessment of STS learning.

Aikenhead, Glen S., & Ryan, A. G. (1986). High School Students Views on Science, Technology, and Society, Ottawa: Social Sciences and Humanities Research Council.

Aikenhead, Glen S. (1987). High-school graduates' beliefs about science-technology-society. Characteristics and limitations of scientific knowledge. Science Education, 71, 459-487.

Aikenhead, Glen S. (1988). An analysis of four ways of assessing student beliefs about STS topics. Journal of Research in Science Teaching, 25(8), 607-630.

Brunkhorst, Bonnie J. (1987). Exemplary Middle and Junior High Science Programs: An Assessment of Teacher Characteristics and Student Outcomes. Doctoral dissertation, The University of Iowa.

Fleming, Reginald W. (1984). Social and Non-Social Cognitive Structures in Decision Making in Socio-Scientific Issues: Implications for Science-Technology-Society Curricula. Doctoral dissertation, University of California at Berkeley.

Fleming, Reg W. (1986a). Adolescent reasoning in socio-scientific issues. Part I: social cognition. Journal of Research in Science Teaching, 23(8), 677-688.

Fleming, Reg W. (1986b). Adolescent reasoning in socio-scientific issues. Part II: nonsocial cognition. Journal of Research in Science Teaching, 23(8), 689-698.

The Iowa Assessment Package for Testing in Five Domains of Science, Eds. William F. McComas, Robert E. Yager, Science Education Center, Van Allen Hall, The University of Iowa, Iowa City, IA 52242, 1988 (A set of papers that discuss and give references to multiple tests for the various domains with special attention to STS).

Test of Attitudes on Technology-Society Interaction, Contact: Dr. E. Joseph Piel, 192 Gould Avenue, North Caldwell, NJ 07006 (Retired Professor of Technology & Society, SUNY - Stony Brook).

Views on Science, Technology, and Society, version CDN.mc.5, Contact: Dr. Glen Aikenhead, Curriculum Studies, College of Education, University of Saskatchewan, Saskatoon, Sask., Canada, S7N 0W0 (A test battery of items that has been developed, revised, and validated with a pool of +10,800 graduating Canadian high school students. A computer-based item management system is also under development. Substitution within the test items is permitted to tailor a more local version).

TEACHER IN-SERVICE WORKSHOP MATERIALS

In addition to materials listed above in the information resources and curriculum materials sections, the following resources should be considered:

Science, Technology, Society - Training Manual, Laurel R. Singleton, Social Science Education Consortium Inc., Boulder, CO, 1988, 164 pp. [A text specifically designed and used by SSEC in their STS teacher training workshops. The

first section introduces STS to teachers (assumes no previous exposure). The next five sections address the design of a training program, introducing STS to teachers and students, fitting STS into the curriculum, implementing STS, and evaluating STS programs. Two appendices consist of 18 transparency masters and teaching strategies for STS. A list of other materials available from the Consortium completes the volume].

Copies of the most recent edition of the STS Reporter are free in quantities to educators conducting state, district, or local level STS workshops. Contact: Project Coordinator, National STS Network, 117 Willard Building, The Pennsylvania State University, University Park, PA 16802 or phone (814) 865-2226.

SOURCES FOR CURRENT PERIODICAL LITERATURE

Traking down recent, relevant information related to STS issues can be difficult since they span such a wide range of disciplines. The following list of specialized periodicals that index and/or abstract periodical literature related to STS issues might assist your search. Popular literature can be located through The Reader's Guide to Periodical Literature.

Air Pollution Titles, (Center for Air Environment Studies, The Pennsylvania State University)
Bibliography of Agriculture, (Oryx Press)
Bulletin of Science, Technology & Society, (Materials Research Laboratory, Penn State University, extended annotated bibliographies of books and periodicals grouped by subjects in each issue by Joseph Haberer of Purdue University)
Current Advances in Ecological and Environmental Sciences (Pergamon Press)
Current Contents, (Institute for Scientific Information, Philadelphia. Note: there are different sets of this publication for specific subareas within science and technology)
Ecological Abstracts, (GeoAbstracts Ltd., Norwich, England)
Environmental Abstracts (R. R. Bowker Publishing Company)
Environmental Periodicals Bibliography, (Environmental Studies Institute)
Food Science and Technology Abstracts, (International Food Information Service)
International Biodeterioration, (Commonwealth Agricultural Bureaux, Farnham Royal Slough)
International Development Abstracts, (Elsevier)
International Petroleum Abstracts, (Institute of Petroleum, London)
Isis, (History of Science Society, annual bibliography as part of their regular quarterly)
Pollution Abstracts, (Cambridge Scientific Abstracts)
Risk Abstracts, (Institute for Risk Research, University of Waterloo Press)
Selected Water Resources Abstracts, (Geological Survey, U.S. Department of the Interior)
Technology and Culture (Society for the History of Technology, annual bibliography as part of their regular quarterly)
Wildlife Review, (U. S. Fish and Wildlife Service)

Many of the above abstract and bibliographic publications are also available on-line with one or more of the following services: DIALOG, ORBIT Infoline, ESA-IRS, DIMDI, Data-Star, and Bibliographic Retrieval Systems. Some of the above publications are also on CD-ROM at major libraries.

SOURCES FOR FILMS AND VIDEOTAPES DEALING WITH STS ISSUES

There are three major rental sources and two other noteworthy sources for films and videocassettes that can be rented at reasonable rates by schools. A description of the services provided by Penn State is provided here with the understanding that analogous types of services are provided by the other centers.

Penn State maintains a large and growing collection of over 6,000 16 mm films and videotapes. Borrowers nationwide can obtain these media by using Penn State's free catalogs to order films over a toll free line once an account is established. A yearly Alphabetical Listing of Penn State Media (1989-90), gives the title of the media, producer identification, copyright year, length of media, 16mm/VHS/U-mat format availability, color/b & w designation, and the cost of the rental. Paragraph descriptions of the contents of the media must be obtained by finding them in the relevant subject-area catalogs or their frequent supplements. Some media can also be purchased outright. The following publications are available at present:

Alphabetical Listing of Penn State Media (1989-90)
Penn State Media Sales Catalog (1988-89)
Subject-Area Media Catalogs:

- Arts and Communications (first edition)
- Black Studies (second edition)
- Business and Economics (second edition)
- Education and Teacher Training (fifth edition)
- Health Sciences (first edition)
- History and Politics (sixth edition)
- Life Sciences (third edition)
- Mathematics and Physical Sciences (eighth edition)
- PCR: Films & Video in the Behavioral Sciences (1988)
- Sociology (fourth edition)
- The Visualization of Anthropology (fifth edition)
- Women's Studies (fourth edition)

Updates are frequent supplements to the paperback catalogs and are produced every few years. They are sent automatically when catalogs are requested. Occasional supplemental information releases include such titles as "Selected Media Dealing with Ethical Issues". Penn State and the University of Illinois also provide a free reference/research service. If you know the title of a film but cannot locate a supplier, they will find it for you if it is available through any public or private lending library in America.

Penn State Audio-Visual Services
University Division of Media and Learning Resources
Special Services Building
The Pennsylvania State University
University Park, PA 16802
(800) 826-0132
(814) 865-6314

Indiana University
Audio-Visual Center
Bloomington, IN 47405
(800) 552-8620

University of Illinois
University Film Center
1325 South Oak Street
Champaign, IL 61820
(800) 367-3456

University of Wisconsin
Audio-Visual Center
127 Wing Communications
1705 State Street
LaCrosse, WI 54601
(800) 831-9504

Kent State University
Audio-Visual Services
330 University Library
Kent, OH 44242
(800) 338-5718

An additional source of films and media is the National Audiovisual Center which has more than 8,000 federally produced audiovisual programs. The current catalog, 1986 Media Resource Catalog, lists over 2,700 titles and descriptions. A 1988 Media Resource Catalog Supplement includes another 400 titles with descriptions. Most of these media programs are available for purchase only. A preview policy enables the purchaser to view the product before making a decision. A good number of titles in the collection relate to STS issues. Further information and catalogs can be obtained from the National Audiovisual Center.

National Audiovisual Center
National Archives and Records Administration
Customer Services Section PZ
8700 Edgeworth Drive
Capitol Heights, MD 20743-3701
(301) 763-1896

SELECTED STS-RELATED COMPUTER SOFTWARE

Locating STS related computer software can be a difficult and time-consuming search through a myriad of publications. Fortunately the R. R. Bowker Company has simplified the search with their publication Software for Schools 1987-88: A Comprehensive Directory of Educational Software, Grades Pre-K through 12(New York, New York, 1987, 1085 pp.). This planned annual volume, contains general articles regarding computers in education, subject listings, title and publisher indexes, a periodicals directory, classroom software/grade level indexes, professional software indexes, and a glossary of terms. Listings of classroom software for the following computers and compatibles is included and listed by type: Apple II family and compatibles; Apple MacIntosh; Atari; Commodore; CP/M, MP/M Enviroments; Digital Equipment Corporation Microcomputers; IBM PC Family and MS-DOS; Radio Shack Tandy Family; Texas Instruments; and UCSC P-Systems.

Two comprehensive sources for reviews of educational software are the monthly publication Software Reviews on File (Facts on File Inc., 460 Park Avenue S, NY, NY 10016, $155 yr., condensations of reviews of software in over 150 publications), and the annual Educational Software Selector (Educational Products Information Exchange Institute, Box 839, Water Mill, NY 11976, $59.95). Additional reviews focused on math and science can be found in the journal of the Association for Computers in Mathematics and Science Teaching, Box 60730, Phoenix, AZ 85082.

Since the overwhelming majority of educational software is for the Apple II family and compatibles, the following selections give an idea of the types and grade levels of software available that relate to STS education. The listings in the R. R. Bowker publication under the title directory gives the release date, grade level, author, publisher, ordering information, price, and a descriptive annotation of one to four sentences.

Acid Rain, Diversified Educational Enterprises Inc. (9-12)
Air Pollution: An Introduction to Computer Models, Educational Materials and Equipment Company (7-12)
Aquatic Ecology Programs Plus, Oakleaf Systems (unspecified)
Balance: A Predator-Prey Simulation, Diversified Educational Enterprises Inc. (9-12)
Biobits V: Profiles in Population, COM Press (9-12)
Birth Defects Series, Intellectual Software (7-12)
The Black Death: An Environmental Simulation, Krell Software Corporation (5-12)
Cardiovascular Fitness Lab, HRM Software (7-12)
The Congressional Bill Simulator, Focus Media Inc. (7-12)
Consumerism and You, Aquarius People Materials Inc. (7-12)
Decisions, EMC Publishing (7-12)
Decisions, Decisions: Television: A Study of Media Ethics, Tom Snyder Productions Inc. (5-12)
Decisions, Decisions: Urbanization: The Growth of Cities, Tom Snyder Productions Inc. (5-8)

Decision Making, Aquarius People Materials Inc. (7-12)
Decision-Making, A Methodical Approach, Orange Juice Software Systems Inc. (7-12)
Ecological Modeling, Conduit (7-12)
Ecology Simulations I & II, Compuware (9-12)
Endangered Species, Yaker Environmental Systems Inc. (7-12)
Endangered Species Databases, Sunburst Communications Inc. (7-12)
Energy Conversion, Focus Media Inc. (7-12)
Energy and Environment, COM Press (9-12)
Energy House, Minnesota Educational Computing Corporation (4-8)
Energy Search, Gregg-McGraw-Hill (5-12)
Energy and the Environment, Dorsett Educational Systems Inc. (10-college)
Food Labels, MCE Inc. (4-12)
Genetics Counselor, Mindscape Inc. (9-12)
Hometown: A Local Area Study, Active Learning Systems (4-12)
How a Bill Becomes a Law, Intellectual Software (7-12)
Human Genetic Disorders, HRM Software (9-12)
Human Populations, Yaker Environmental Systems Inc. (7-12)
The Human Pump, Sunburst Communications Inc. (5-12)
Industrialism in America: An Economic History, Focus Media Inc. (7-12)
Make it Click: Seatbelt Safety, Sunburst Communications Inc. (6-12)
Mangry: Humans, Energy and Environment, Diversified Educational Enterprises Inc. (9-12)
NAS: Nutrient Analysis System, DDA Software (9-12)
Nuclear Reactions, D.C. Heath Co. (7-12)
Personal Consumerism, Aquarius People Materials Inc. (7-12)
Pollute: Impact of Water Pollutants, Diversified Educational Enterprises Inc. (6-12)
Popgro: Population Growth Simulation, Diversified Educational Enterprises Inc. (9-12)
Population Growth Models: Biomathematics, Mathegraphics Software (10-college)
Project: Space Station Classroom Kit, HesWare, Human Engineered Software (unspecified)
Quantitative Literacy Series Software, Dale Seymour Publishers (7-12)
Radioactivity, J & S Software (7-9)
SAMP: Survey Sampling, Conduit (12-college)
Standing Room Only?: A Study in Human Population Growth, Sunburst Communications Inc. (8-12)
Surveys Unlimited, Mindscape Inc. (3-12)
Technology Trivia, Micro Learningware (7-12)
Topics in Research Methods: Power, Conduit (12-college)
The Voting Machine, Career Publishing Inc. (K-12)
The Voyage of the Mimi, Holt, Rinehart and Winston Inc. (unspecified)
Water Pollution, Educational aterials and Equipment Company (7-12)
The Whaling Game, Intellectual Software (unspecified)
Wildlife Series: Limiting Factors and Carrying Capacity, Yaker Environmental Systems Inc. (7-12)